AVT Prosilica GE

Technical Manual

AVT GigE Vision Cameras

V2.0.2

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ALLIED Vision Technologies

Legal notice

For customers in the U.S.A.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interferences will not occur in a particular installation. If the equipment does cause harmful interference to radio or television reception, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the distance between the equipment and the receiver.
- Use a different line outlet for the receiver.
- Consult a radio or TV technician for help.

You are cautioned that any changes or modifications not expressly approved in this manual could void your authority to operate this equipment. The shielded interface cable recommended in this manual must be used with this equipment in order to comply with the limits for a computing device pursuant to Subpart A of Part 15 of FCC Rules.

For customers in Canada

This apparatus complies with the Class A limits for radio noise emissions set out in the Radio Interference Regulations.

Pour utilisateurs au Canada

Cet appareil est conforme aux normes classe A pour bruits radioélectriques, spécifiées dans le Règlement sur le brouillage radioélectrique.

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These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Allied Vision Technologies customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Allied Vision Technologies for any damages resulting from such improper use or sale.

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Contents

Contacting Allied Vision Technologies 5

Introduction 6

Document history 6
Conventions used in this manual 7
Styles 7
Symbols 7
Precautions 8
Cleaning optics 9
Identifying debris 9
Locating debris 9
Color cameras with IR filter 9
Cleaning with air 10
Contact cleaning 10

Conformity 11

Specifications 12

Prosilica GE680/680C 12
Prosilica GE1050/1050C 14
Prosilica GE1650/1650C 16
Prosilica GE1660/1660C 18
Prosilica GE1900/1900C 20
Prosilica GE1910/1910C 22
Prosilica GE2040/2040C 24
Prosilica GE4000/4000C 26
Prosilica GE4900/4900C 28

Camera attribute highlights 30

Filters 31

Camera dimensions 32

Prosilica GE C-Mount (adjustable) 32
Prosilica GE F-Mount: GE2040/2040C 33
Prosilica GE large format F-Mount: GE4000/4000C, GE4900/4900C 34
Tripod adapter 35
Optical flange focal distance 36
C-Mount cross section 36
F-Mount cross section 37
Adjustment of C-Mount 38
Loosen locking ring 38
Image to infinity 38

Adjustment of F-Mount 39
Attach F-Mount compatible lens 39
Loosen F-Mount front assembly 39
Image to infinity 39

Camera interfaces 40

Status LEDs 40
Gigabit Ethernet port 41
Camera I/O connector pin assignment 42
I/O definition 43
Camera power 43
Isolated IO GND 43
RxD RS-232 and TxD RS-232 43
Input triggers 43
Output signals 44
Video iris 45
Reserved 45
Camera I/O connector internal circuit diagram 46
Camera I/O connector external circuit example 47
In 1, Out 1 external circuit example 48
Trigger timing diagram 49
Notes on triggering 49

Firmware update 51

Resolution and ROI frame rates 52

Prosilica GE680 52
Prosilica GE1050 53
Prosilica GE1650 53
Prosilica GE1660 54
Prosilica GE1900 54
Prosilica GE1910 55
Prosilica GE2040 55
Prosilica GE4000 56
Prosilica GE4900 56
Prosilica GE model comparison 57

Additional references 58

Index 59

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Introduction

This **AVT Prosilica GE Technical Manual** describes in depth the technical specifications of the Prosilica GE camera family including dimensions, feature overview, I/O definition, trigger timing waveforms, and frame rate performance.

For information on software installation read the **AVT GigE Installation Manual.** For detailed information on camera features and controls specific to the Prosilica GE refer to the **AVT GigE Camera and Driver Features** and **AVT GigE Camera and Driver Attributes** documents.

www

AVT Prosilica GE literature:
http://www.alliedvisiontec.com/us/support/downloads/product-literature/prosilica-ge.html

Document history

Version	Date	Remarks
V2.0.0	2011-Jul-14	New Manual - SERIAL status
V2.0.1	2013-Jul-05	• Renamed Camera IO signals • Reworked *Cleaning optics* section • Reworked the spectral plots and Frame rate vs.Height graphs • Updated the RoHS directive • Updated the exposure control values in the *Specifications* chapter • Added *Status LEDs* section • Updated the pixel format naming according to the GenICam naming convention • Added frame rate formulas in the *Resolution and ROI frame rates* chapter • Added VIMBA SDK link in *Additional references* section • Updated AVT recommended cabling to category 6 or higher in the *Gigabit Ethernet port* section • Added contact information for Allied Vision Technologies (Shanghai) Co. Ltd. • Updated the links to **AVT GigE Installation Manual** • Added links to **AVT GigE Camera and Driver Features** document

Table 1: Document history

Version	Date	Remarks
V2.0.2	2013-Oct-02	• Added optical flange focal distance and maximum lens protrusion information on page36 • Added a note on locking screw cables on page 41 • Updated *Cleaning optics* section • Updated vertical binning values in the *Specifications* chapter • Updated *Table 12* on page 30 • Updated links for AVT PvAPI SDK

Table 1: Document history

Conventions used in this manual

To give this manual an easily understandable layout and to emphasize important information, the following typographical styles and symbols are used:

Styles

Style	Function	Example
Bold	Programs, inputs, or highlighting important information	**bold**
Courier	Code listings etc.	Input
Upper case	Register	REGISTER
Italics	Modes, fields	*Mode*
Parentheses and/or blue	Links	(Link)

Table 2: Styles

Symbols

Note This symbol highlights important information.

Caution This symbol highlights important instructions. You have to follow these instructions to avoid malfunctions.

www

This symbol highlights URLs for further information. The URL itself is shown in blue.

Example:

http://www.alliedvisiontec.com

Precautions

Caution

Do not disassemble the camera housing. Warranty is void if camera has been disassembled.

This camera contains sensitive internal components.

Caution

Keep shipping material.

Poor packaging of the product may cause damage during shipping.

Caution

Verify all external connections.

Verify all external connections in terms of voltage levels, power requirements, voltage polarity, and signal integrity prior to powering the device.

Caution

Cleaning.

This product can be damaged by some volatile cleaning agents. Avoid cleaning the image sensor unless absolutely necessary. Please see instructions on optics cleaning in this document.

Caution

Do not exceed environmental specifications.

See environmental specifications limits in the *Specifications* chapter of this document. Special care must be taken to maintain a reasonable operating temperature. If the camera is operated in temperatures higher than the specified range, the camera should be mounted on a heat sink.

Cleaning optics

Caution

AVT does not warranty against any physical damage to the sensor/filter/protection glass or lenses. **Use utmost care when cleaning optical components**.

Caution

Do not touch any optics with fingers. Oil from fingers can damage fragile optical coatings.

Identifying debris

Debris on the image sensor or optical components appears as a darkened area or smudge on a camera image. Do not confuse this with a pixel defect which appears as a distinct point.

Locating debris

First determine whether the debris is on the sensor glass, IR filter (if used), or lens. The farther away the debris is from the sensor, the blurrier the debris appears on a camera image.

Stream a live image from the camera using a uniform target, such as a piece of paper. To determine if the debris is on the camera lens, rotate the lens independent of the camera. If the spot moves, the debris is on the lens. Otherwise, the debris is on the IR filter (if used) or sensor glass.

Color cameras with IR filter

Prosilica GE color cameras are equipped with an IR filter. With no lens or lens cap on a camera, the IR filter is exposed and debris can accumulate on it. This is the most probable location for debris. It should not be necessary to remove the IR filter for cleaning. Clean the outside of the IR filter glass using the techniques explained in the next section.

If it is determined that the debris is on the inside surface of the filter glass, or the sensor glass, IR filter removal is necessary. Depending on the manufacturing date of your Prosilica GE camera, the IR filter may be slot type, or pinhole type. Slot type filters can be removed using a small flat head screw driver. Pinhole type filters require a pin spanner wrench for removal.

Note

A pin spanner wrench suitable for IR filter removal is available for purchase from AVT.
AVT P/N: E9020001

Cleaning with air

Blow directly on the contaminated surface with moderate pressure, clean compressed air.

Caution

Do not exceed 6 bar (90 psi). If using canned air, approximately ~ 4.8 bar (70 psi) when full, do not shake or tilt the can, as extreme changes in temperature due to sudden cold air can crack the optic glass.

View a live image with the camera after blowing. If debris is still present, repeat the process until it is determined that the particulate cannot be dislodged. If this is the case, proceed to the contact cleaning technique.

Contact cleaning

Only use this method if the above air cleaning method does not sufficiently clean the surface. Use 99% pure isopropyl alcohol and clean cotton swabs. Wet the swab in the alcohol. Quickly wipe the optics in a single stroke. Prolonged exposure of alcohol on the swab can cause the swab glue to loosen and transfer to the optic glass. Do not reuse the same swab. Repeat this process until the debris is removed. If this process fails to remove the debris, contact AVT.

Conformity

Allied Vision Technologies declares under its sole responsibility that all standard cameras of the **AVT Prosilica GE** family to which this declaration relates are in conformity with the following standard(s) or other normative document(s):

- CE, following the provisions of 2004/108/EG directive
- FCC Part 15 Class A
- RoHS (2011/65/EU)

CE

We declare, under our sole responsibility, that the previously described **AVT Prosilica GE** cameras conform to the directives of the CE.

FC

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential environment. This equipment generates radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Any modifications not expressly approved in this manual may void your authority to operate this equipment.

Specifications
Prosilica GE680/680C

Feature	Specification
Resolution	640 x 480
Sensor	Truesense KAI-0340
Type	CCD Progressive
Sensor size	Type 1/3
Cell size	7.4 µm
Lens mount	C (adjustable)
Max frame rate at full resolution	205 fps
A/D	12 bit
On-board FIFO	32 MB
Bit depth	8/12
Mono formats	GE680: Mono8, Mono12, Mono12Packed GE680C: Mono8
Color formats	BayerGR8, BayerGR12, BayerGR12Packed, RGB8Packed, BGR8Packed, RGBA8Packed, BGRA8Packed, RGB12Packed, YUV411Packed
Exposure control	25 µs to 53.7 s; 1 µs increments
Gain control	0 to 34 dB
Horizontal binning	1 to 8 pixels
Vertical binning	1 to full resolution
TTL I/Os	1 input, 3 output
RS-232	1
Power requirements	5–16 VDC: Cameras SN: 02-XXXX**A**-XXXXX, 02-XXXX**B**-XXXXX 5–25 VDC: Cameras SN: 02-XXXX**C**-XXXXX
Power consumption	Typical < 4.5 W (@ 12 VDC); (full resolution and maximal frame rates)
Mass	169 g (without lens)
Body dimensions (L x W x H)	80 x 51 x 39 mm (including connectors, w/o tripod and lens)
Operating temperature	0 to +50 °C ambient temperature (without condensation)
Storage temperature	-10 to +70 °C ambient temperature (without condensation)
Trigger latency	1.2 µs
Trigger jitter	±10 ns
tpd	90 ns
Operating humidity	20 to 80% non-condensing
Hardware interface standard	IEEE 802.3 1000BASE-T, 100BASE-TX
Software interface standard	GigE Vision Standard 1.2
Regulatory	CE, FCC Class A, RoHS (2011/65/EU)

Table 3: Prosilica GE680/680C camera specifications

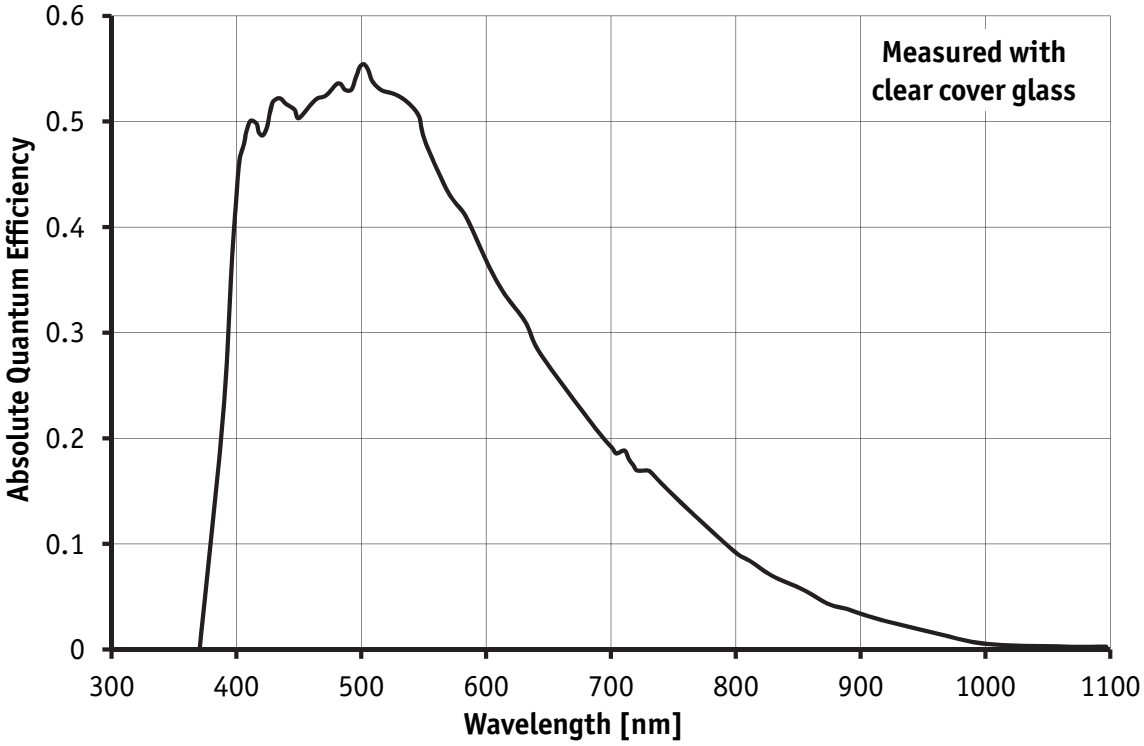


Figure 1: Prosilica GE680 monochrome spectral response

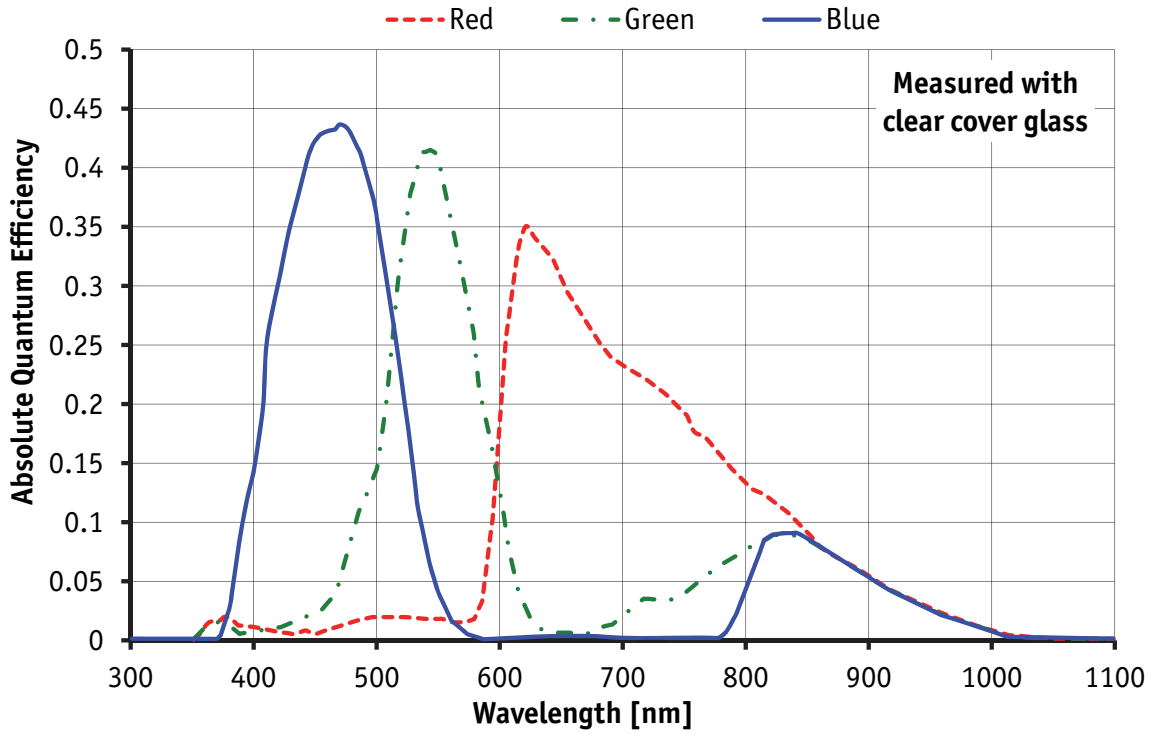


Figure 2: Prosilica GE680C color spectral response (without IR cut filter)

Prosilica GE1050/1050C

Feature	Specification
Resolution	1024 x 1024
Sensor	Truesense KAI-01050
Type	CCD Progressive
Sensor size	Type 1/2
Cell size	5.5 µm
Lens mount	C (adjustable)
Max frame rate at full resolution	59 fps
A/D	12 bit
On-board FIFO	32 MB
Bit depth	8/12
Mono formats	GE1050: Mono8, Mono12, Mono12Packed GE1050C: Mono8
Color formats	BayerGR8, BayerGR12, BayerGR12Packed, RGB8Packed, BGR8Packed, RGBA8Packed, BGRA8Packed, RGB12Packed, YUV411Packed
Exposure control	10 µs to 53.7 s; 1 µs increments
Gain control	0 to 34 dB
Horizontal binning	1 to 8 pixels
Vertical binning	1 to full resolution
TTL I/Os	1 input, 3 output
RS-232	1
Power requirements	5–16 VDC: Cameras SN: 02-XXXX**A**-XXXXX, 02-XXXX**B**-XXXXX 5–25 VDC: Cameras SN: 02-XXXX**C**-XXXXX
Power consumption	Typical < 5 W (@ 12 VDC); (full resolution and maximal frame rates)
Mass	178 g (without lens)
Body dimensions (L x W x H)	80 x 51 x 39 mm (including connectors, w/o tripod and lens)
Operating temperature	0 to +50 °C ambient temperature (without condensation)
Storage temperature	-10 to +70 °C ambient temperature (without condensation)
Trigger latency	5 µs
Trigger jitter	±10 ns
tpd	90 ns
Operating humidity	20 to 80% non-condensing
Hardware interface standard	IEEE 802.3 1000BASE-T, 100BASE-TX
Software interface standard	GigE Vision Standard 1.2
Regulatory	CE, FCC Class A, RoHS (2011/65/EU)

Table 4: Prosilica GE1050/1050C camera specifications

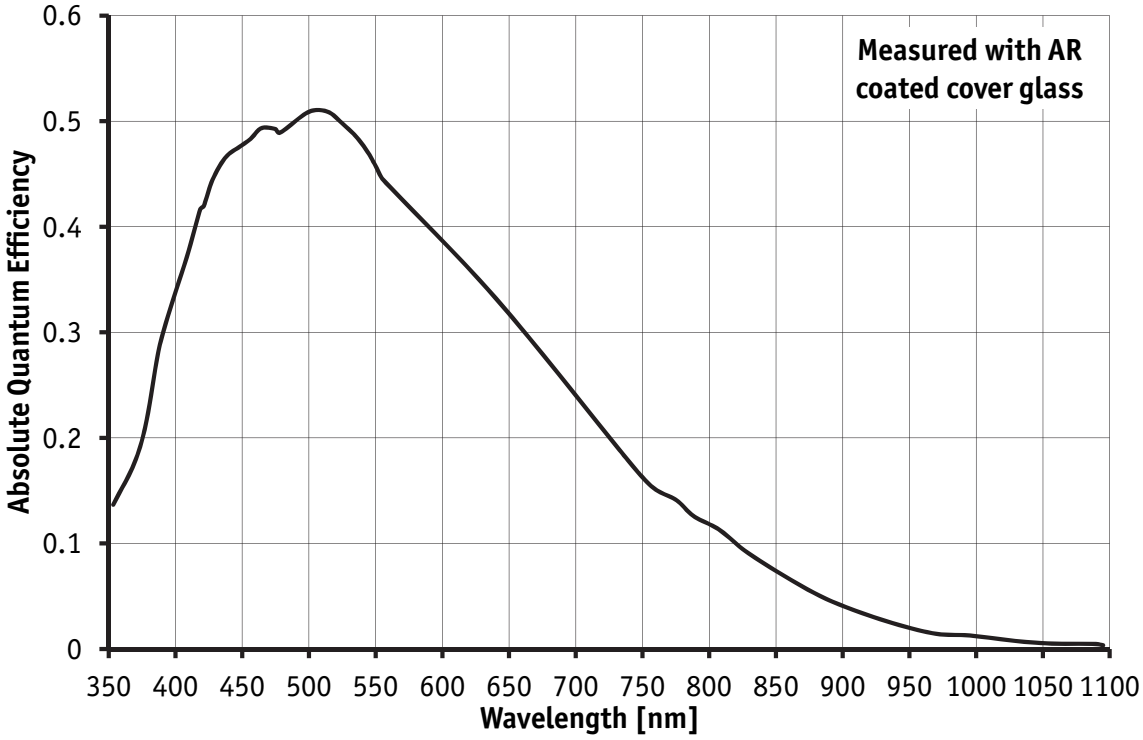


Figure 3: Prosilica GE1050 monochrome spectral response

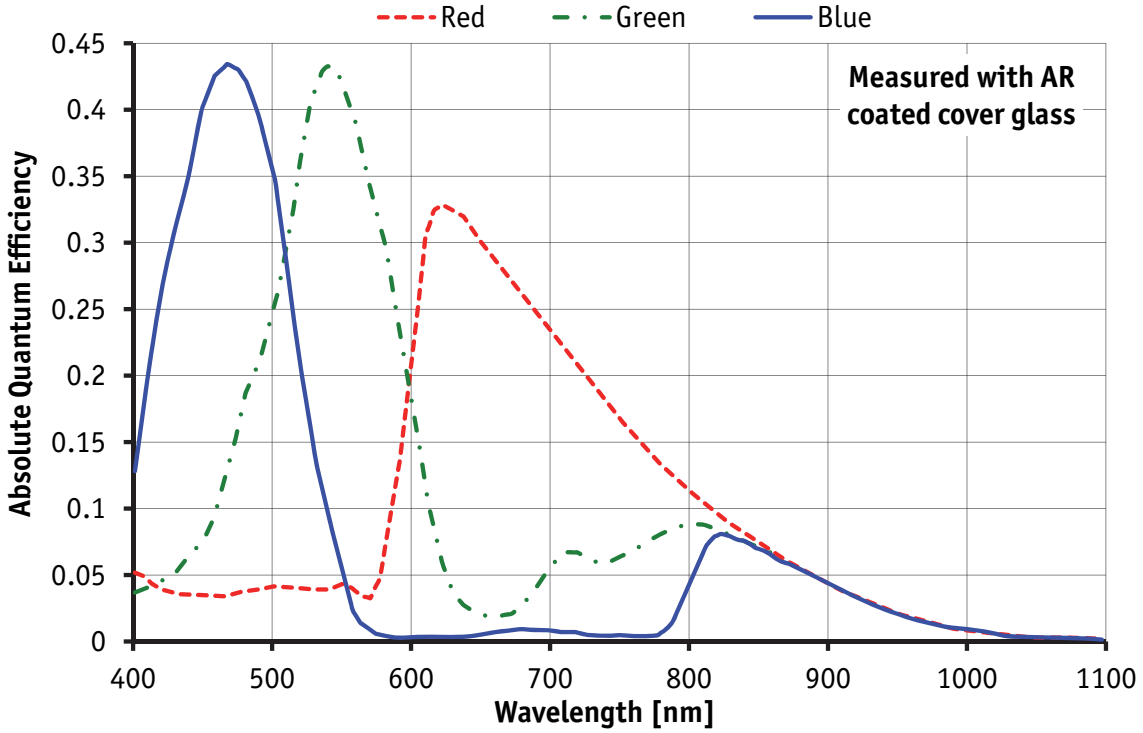


Figure 4: Prosilica GE1050C color spectral response (without IR cut filter)

Prosilica GE1650/1650C

Feature	Specification
Resolution	1600 x 1200
Sensor	Truesense KAI-2020
Type	CCD Progressive
Sensor size	1 inch
Cell size	7.4 µm
Lens mount	C (adjustable)
Max frame rate at full resolution	32 fps
A/D	12 bit
On-board FIFO	32 MB
Bit depth	8/12
Mono formats	GE1650: Mono8, Mono12, Mono12Packed GE1650C: Mono8
Color formats	BayerGR8, BayerGR12, BayerGR12Packed, RGB8Packed, BGR8Packed, RGBA8Packed, BGRA8Packed, RGB12Packed, YUV411Packed
Exposure control	50 µs to 53.7 s; 1 µs increments
Gain control	0 to 34 dB
Horizontal binning	1 to 8 pixels
Vertical binning	1 to full resolution
TTL I/Os	1 input, 3 output
RS-232	1
Power requirements	5–16 VDC: Cameras SN: 02-XXXX**A**-XXXXX, 02-XXXX**B**-XXXXX 5–25 VDC: Cameras SN: 02-XXXX**C**-XXXXX
Power consumption	Typical < 5 W (@ 12 VDC); (full resolution and maximal frame rates)
Mass	169 g (without lens)
Body dimensions (L x W x H)	80 x 51 x 39 mm (including connectors, w/o tripod and lens)
Operating temperature	0 to +50 °C ambient temperature (without condensation)
Storage temperature	-10 to +70 °C ambient temperature (without condensation)
Trigger latency	5 µs
Trigger jitter	±10 ns
tpd	90 ns
Operating humidity	20 to 80% non-condensing
Hardware interface standard	IEEE 802.3 1000BASE-T, 100BASE-TX
Software interface standard	GigE Vision Standard 1.2
Regulatory	CE, FCC Class A, RoHS (2011/65/EU)

Table 5: Prosilica GE1650/1650C camera specifications

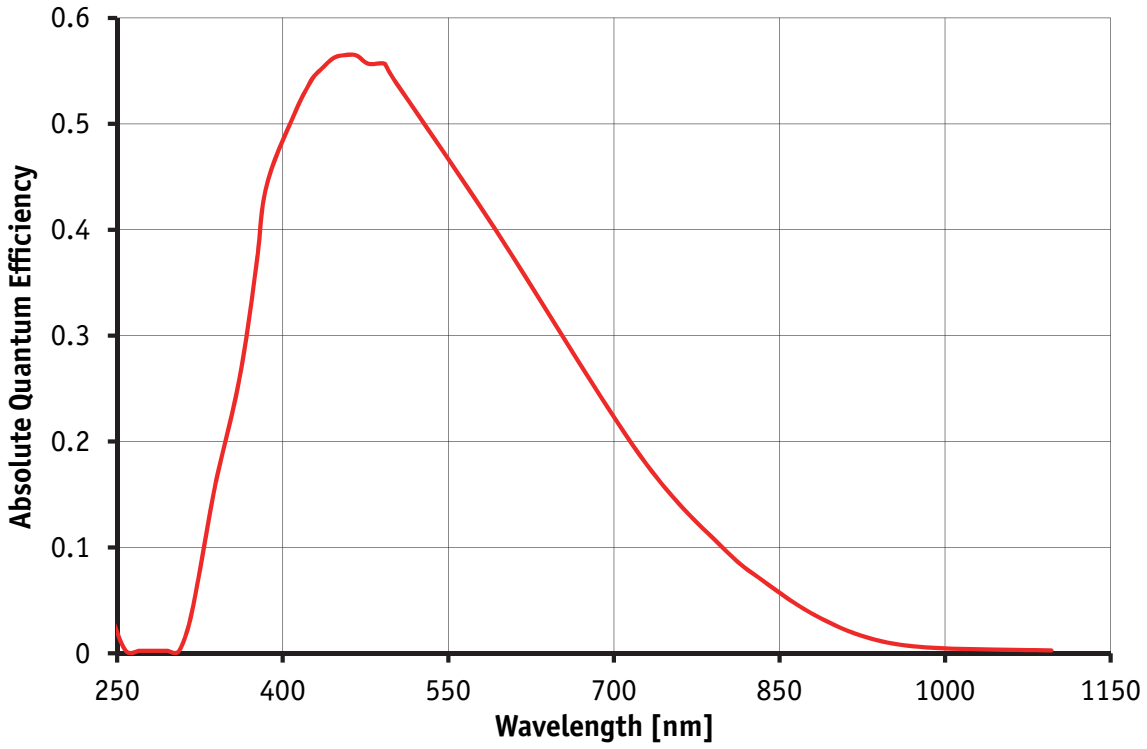


Figure 5: Prosilica GE1650 monochrome spectral response

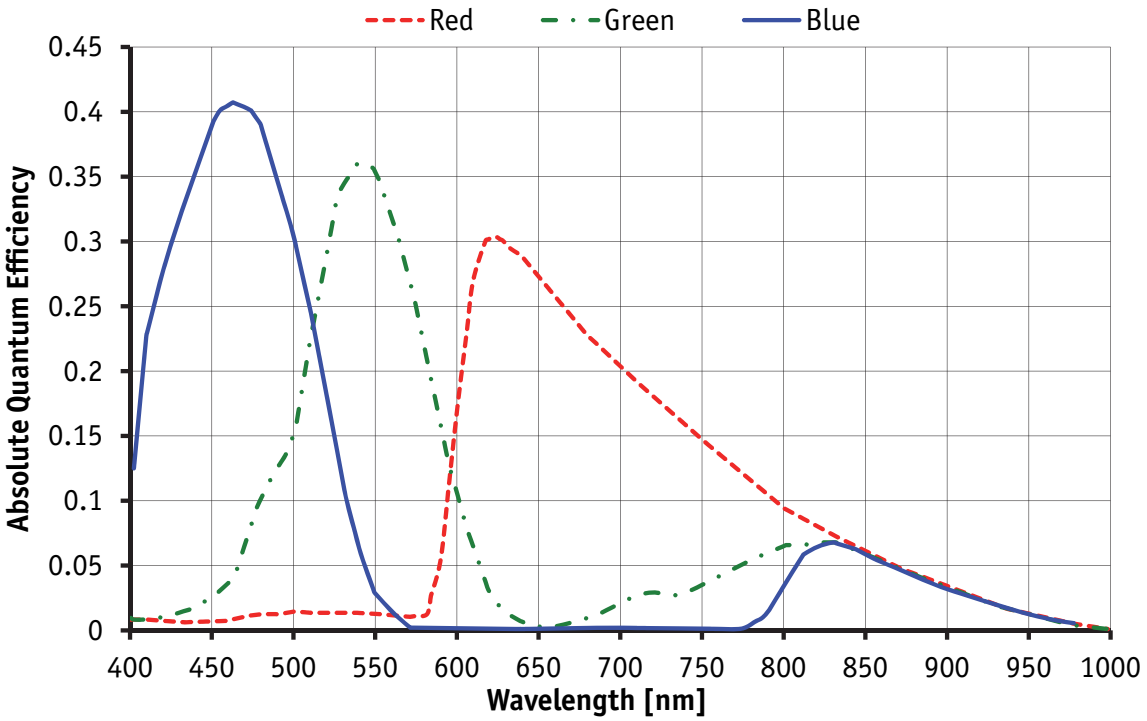


Figure 6: Prosilica GE1650C color spectral response (without IR cut filter)

Prosilica GE1660/1660C

Feature	Specification
Resolution	1600 x 1200
Sensor	Truesense KAI-2050
Type	CCD Progressive
Sensor size	2/3 inch
Cell size	5.5 µm
Lens mount	C (adjustable)
Max frame rate at full resolution	34.6 fps
A/D	12 bit
On-board FIFO	32 MB
Bit depth	8/12
Mono formats	GE1660: Mono8, Mono12, Mono12Packed GE1660C: Mono8
Color formats	BayerGR8, BayerGR12, BayerGR12Packed, RGB8Packed, BGR8Packed, RGBA8Packed, BGRA8Packed, RGB12Packed, YUV411Packed
Exposure control	10 µs to 53.7 s; 1 µs increments
Gain control	0 to 34 dB
Horizontal binning	1 to 8 pixels
Vertical binning	1 to full resolution
TTL I/Os	1 input, 3 output
RS-232	1
Power requirements	5–16 VDC: Cameras SN: 02-XXXX**A**-XXXXX, 02-XXXX**B**-XXXXX 5–25 VDC: Cameras SN: 02-XXXX**C**-XXXXX
Power consumption	Typical < 5 W (@ 12 VDC); (full resolution and maximal frame rates)
Mass	178 g (without lens)
Body dimensions (L x W x H)	80 x 51 x 39 mm (including connectors, w/o tripod and lens)
Operating temperature	0 to +50 °C ambient temperature (without condensation)
Storage temperature	-10 to +70 °C ambient temperature (without condensation)
Trigger latency	5 µs
Trigger jitter	±10 ns
tpd	90 ns
Operating humidity	20 to 80% non-condensing
Hardware interface standard	IEEE 802.3 1000BASE-T, 100BASE-TX
Software interface standard	GigE Vision Standard 1.2
Regulatory	CE, FCC Class A, RoHS (2011/65/EU)

Table 6: Prosilica GE1660/1660C camera specifications

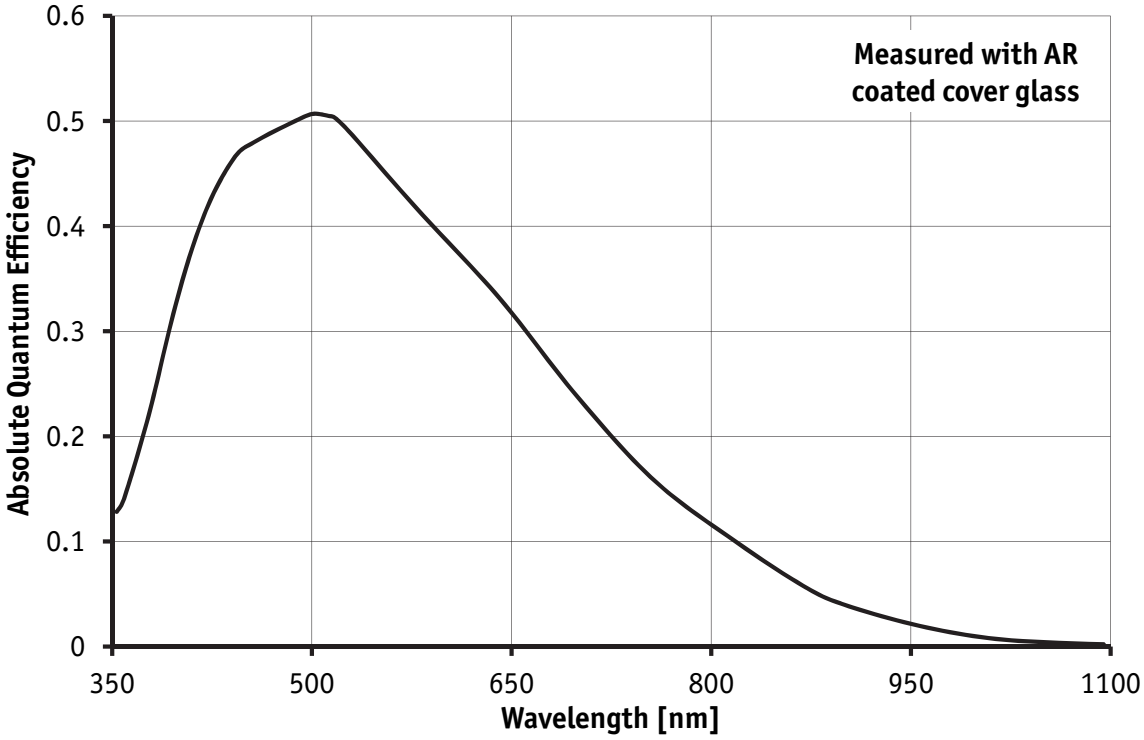


Figure 7: Prosilica GE1660 monochrome spectral response

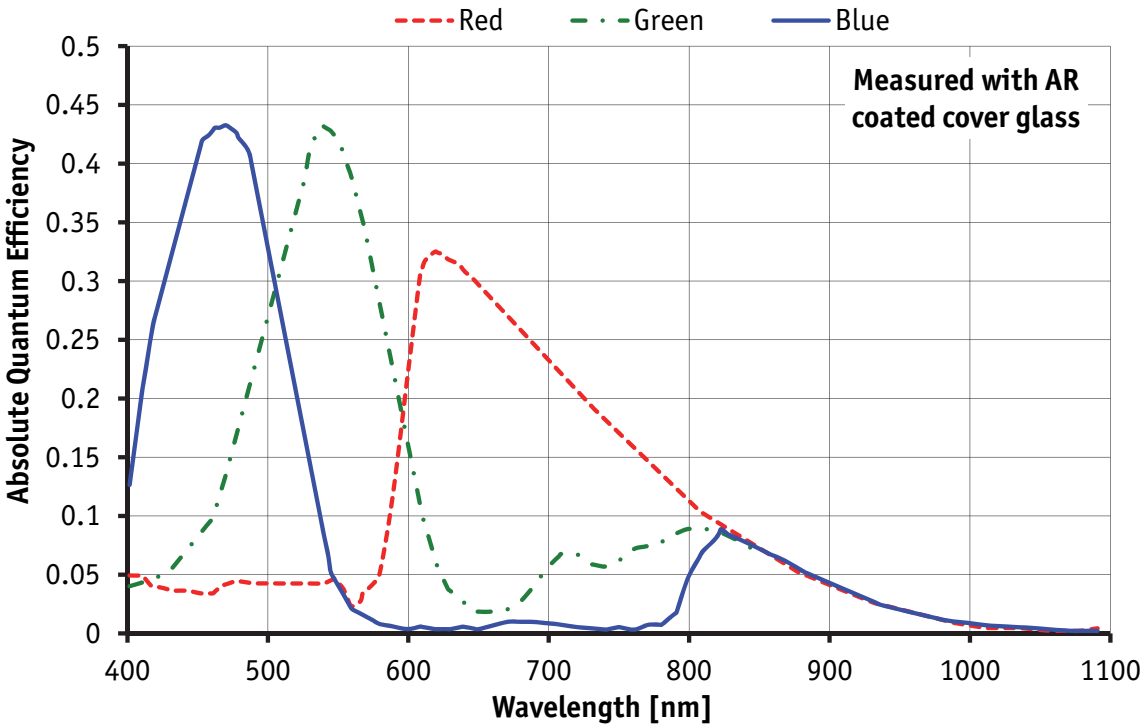


Figure 8: Prosilica GE1660C color spectral response (without IR cut filter)

Prosilica GE1900/1900C

Feature	Specification
Resolution	1920 x 1080
Sensor	Truesense KAI-2093
Type	CCD Progressive
Sensor size	1 inch
Cell size	7.4 µm
Lens mount	C (adjustable)
Max frame rate at full resolution	30 fps
A/D	12 bit
On-board FIFO	32 MB
Bit depth	8/12
Mono formats	GE1900: Mono8, Mono12, Mono12Packed GE1900C: Mono8
Color formats	BayerGR8, BayerGR12, BayerGR12Packed, RGB8Packed, BGR8Packed, RGBA8Packed, BGRA8Packed, RGB12Packed, YUV411Packed
Exposure control	50 µs to 53.7 s; 1 µs increments
Gain control	0 to 34 dB
Horizontal binning	1 to 8 pixels
Vertical binning	1 to full resolution
TTL I/Os	1 input, 3 output
RS-232	1
Power requirements	5–16 VDC: Cameras SN: 02-XXXX**A**-XXXXX, 02-XXXX**B**-XXXXX 5–25 VDC: Cameras SN: 02-XXXX**C**-XXXXX
Power consumption	Typical < 5 W (@ 12 VDC); (full resolution and maximal frame rates)
Mass	169 g (without lens)
Body dimensions (L x W x H)	80 x 51 x 39 mm (including connectors, w/o tripod and lens)
Operating temperature	0 to +50 °C ambient temperature (without condensation)
Storage temperature	-10 to +70 °C ambient temperature (without condensation)
Trigger latency	5 µs
Trigger jitter	±10 ns
tpd	90 ns
Operating humidity	20 to 80% non-condensing
Hardware interface standard	IEEE 802.3 1000BASE-T, 100BASE-TX
Software interface standard	GigE Vision Standard 1.2
Regulatory	CE, FCC Class A, RoHS (2011/65/EU)

Table 7: Prosilica GE1900/1900C camera specifications

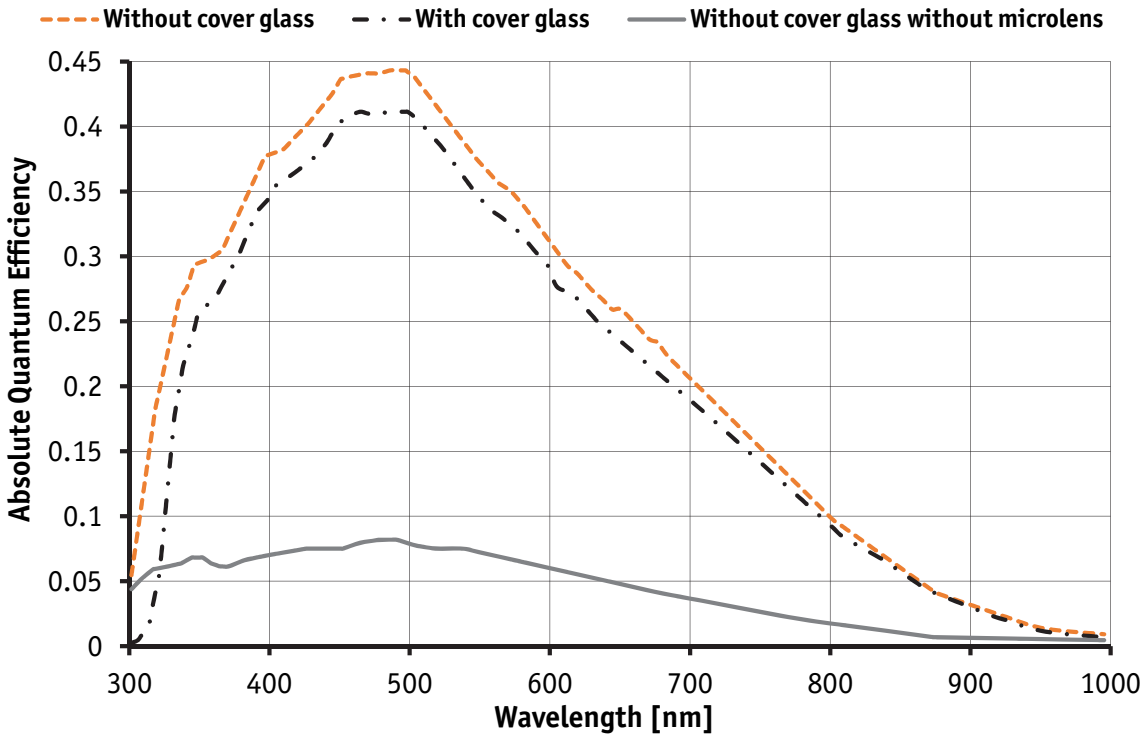


Figure 9: Prosilica GE1900 monochrome spectral response

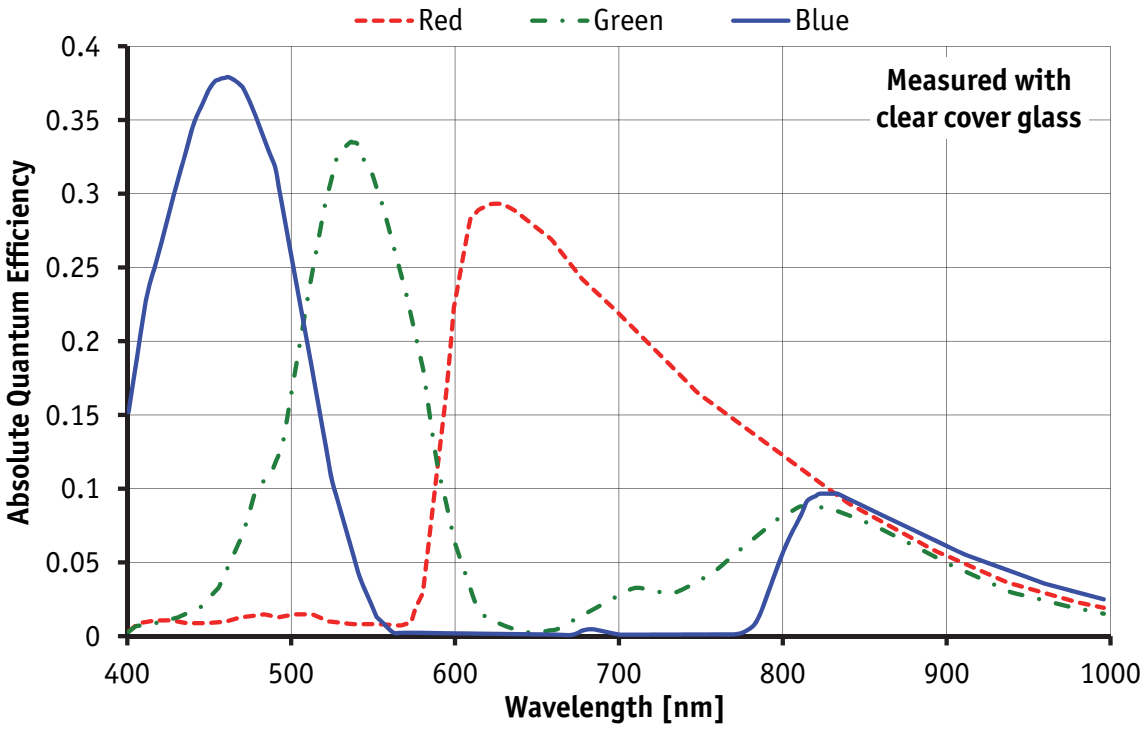


Figure 10: Prosilica GE1900C color spectral response (without IR cut filter)

Prosilica GE1910/1910C

Feature	Specification
Resolution	1920 x 1080
Sensor	Truesense KAI-02150
Type	CCD Progressive
Sensor size	2/3 inch
Cell size	5.5 µm
Lens mount	C (adjustable)
Max frame rate at full resolution	32 fps
A/D	12 bit
On-board FIFO	32 MB
Bit depth	8/12
Mono formats	GE1910: Mono8, Mono12, Mono12Packed GE1910C: Mono8
Color formats	BayerGR8, BayerGR12, BayerGR12Packed, RGB8Packed, BGR8Packed, RGBA8Packed, BGRA8Packed, RGB12Packed, YUV411Packed
Exposure control	10 µs to 53.7 s; 1 µs increments
Gain control	0 to 34 dB
Horizontal binning	1 to 8 pixels
Vertical binning	1 to full resolution
TTL I/Os	1 input, 3 output
RS-232	1
Power requirements	5–16 VDC: Cameras SN: 02-XXXX**A**-XXXXX, 02-XXXX**B**-XXXXX 5–25 VDC: Cameras SN: 02-XXXX**C**-XXXXX
Power consumption	Typical < 5 W (@ 12 VDC); (full resolution and maximal frame rates)
Mass	178 g (without lens)
Body dimensions (L x W x H)	80 x 51 x 39 mm (including connectors, w/o tripod and lens)
Operating temperature	0 to +50 °C ambient temperature (without condensation)
Storage temperature	-10 to +70 °C ambient temperature (without condensation)
Trigger latency	5 µs
Trigger jitter	±10 ns
tpd	90 ns
Operating humidity	20 to 80% non-condensing
Hardware interface standard	IEEE 802.3 1000BASE-T, 100BASE-TX
Software interface standard	GigE Vision Standard 1.2
Regulatory	CE, FCC Class A, RoHS (2011/65/EU)

Table 8: Prosilica GE1910/1910C camera specifications

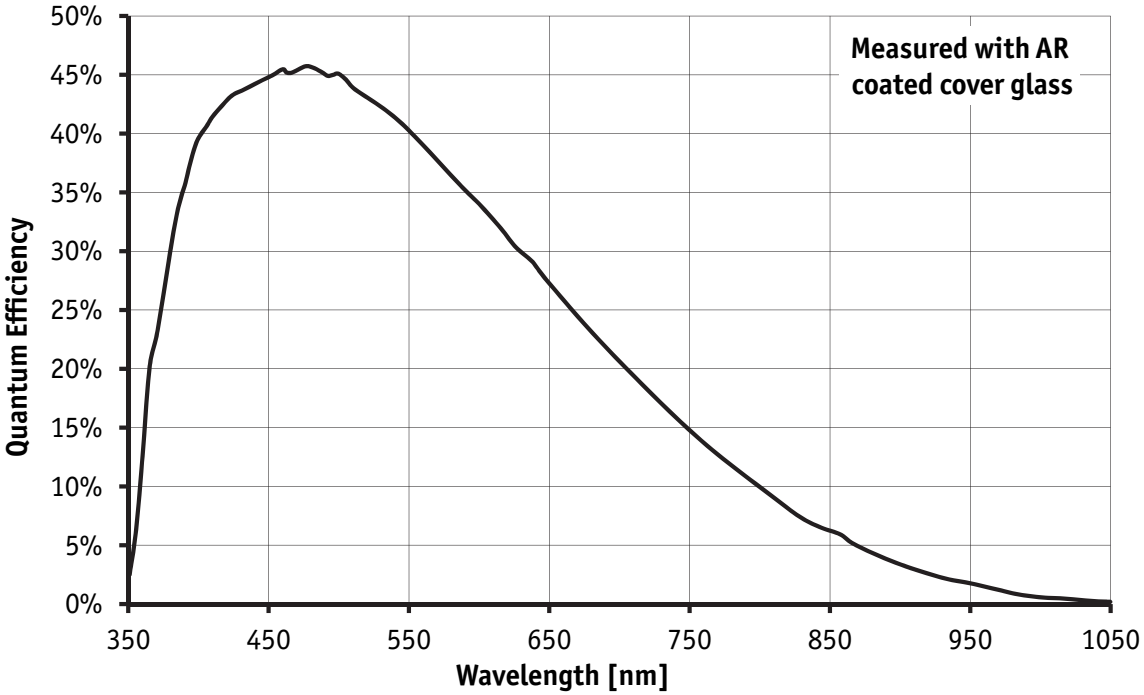


Figure 11: Prosilica GE1910 monochrome spectral response

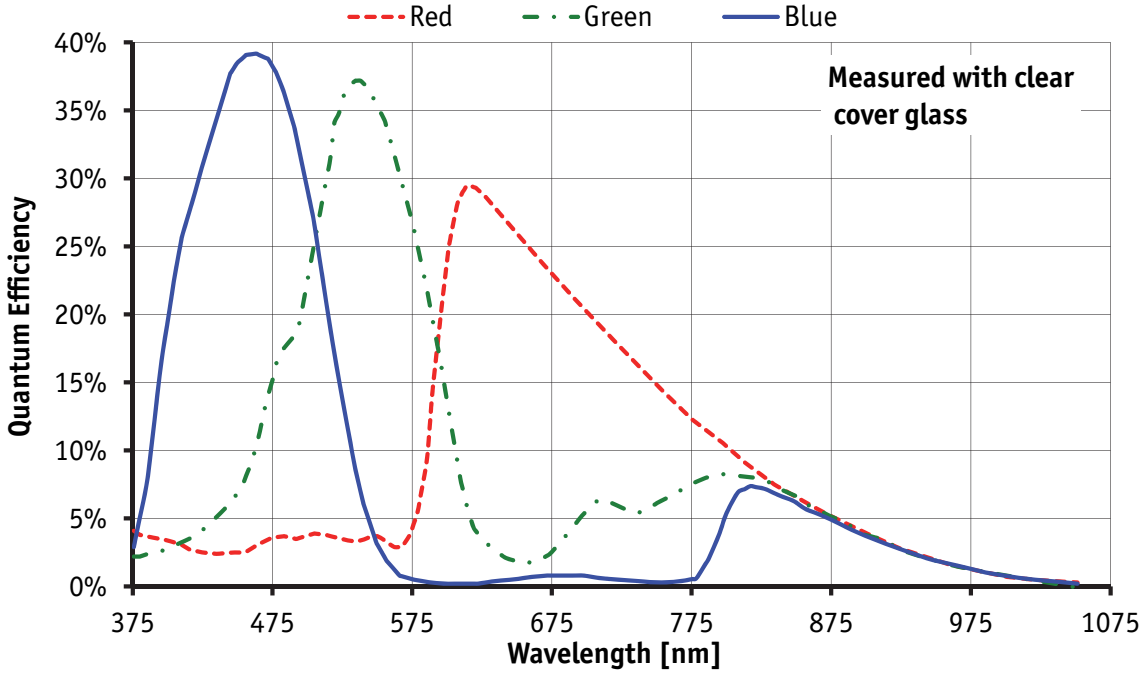


Figure 12: Prosilica GE1910C color spectral response (without IR cut filter)

Prosilica GE2040/2040C

Feature	Specification
Resolution	2040 x 2048
Sensor	Truesense KAI- 04022
Type	CCD Progressive
Sensor size	1.2 inch
Cell size	7.4 µm
Lens mount	C (adjustable) / F
Max frame rate at full resolution	15 fps
A/D	12 bit
On-board FIFO	32 MB
Bit depth	8/12
Mono formats	GE2040: Mono8, Mono12, Mono12Packed GE2040C: Mono8
Color formats	BayerGR8, BayerGR12, BayerGR12Packed, RGB8Packed, BGR8Packed, RGBA8Packed, BGRA8Packed, RGB12Packed, YUV411Packed
Exposure control	75 µs to 53.7 s; 1 µs increments
Gain control	0 to 34 dB
Horizontal binning	1 to 8 pixels
Vertical binning	1 to full resolution
TTL I/Os	1 input, 3 output
RS-232	1
Power requirements	5–16 VDC: Cameras SN: 02-XXXX**A**-XXXXX, 02-XXXX**B**-XXXXX 5–25 VDC: Cameras SN: 02-XXXX**C**-XXXXX
Power consumption	Typical < 5.5 W (@ 12 VDC); (full resolution and maximal frame rates)
Mass	169 g (without lens)
Body dimensions (L x W x H)	80 x 51 x 39 mm (including connectors, w/o tripod and lens)
Operating temperature	0 to +50 °C ambient temperature (without condensation)
Storage temperature	-10 to +70 °C ambient temperature (without condensation)
Trigger latency	4.2 µs
Trigger jitter	±10 ns
tpd	90 ns
Operating humidity	20 to 80% non-condensing
Hardware interface standard	IEEE 802.3 1000BASE-T, 100BASE-TX
Software interface standard	GigE Vision Standard 1.2
Regulatory	CE, FCC Class A, RoHS (2011/65/EU)

Table 9: Prosilica GE2040/2040C camera specifications

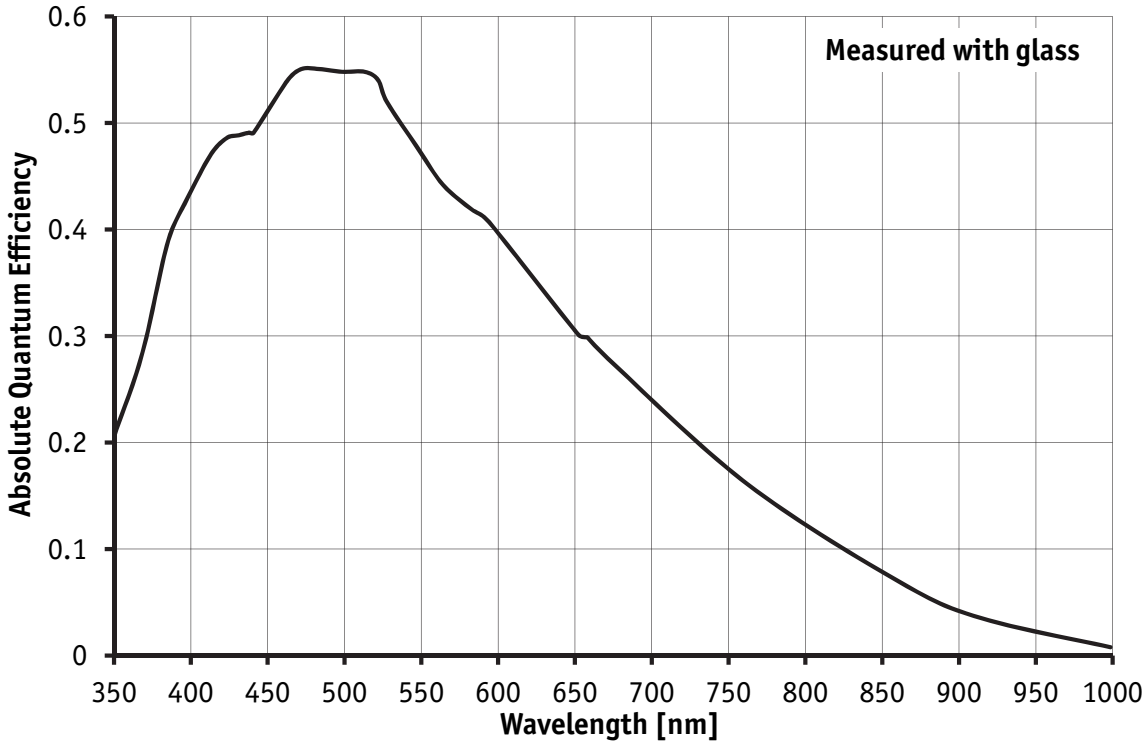


Figure 13: Prosilica GE2040 monochrome spectral response

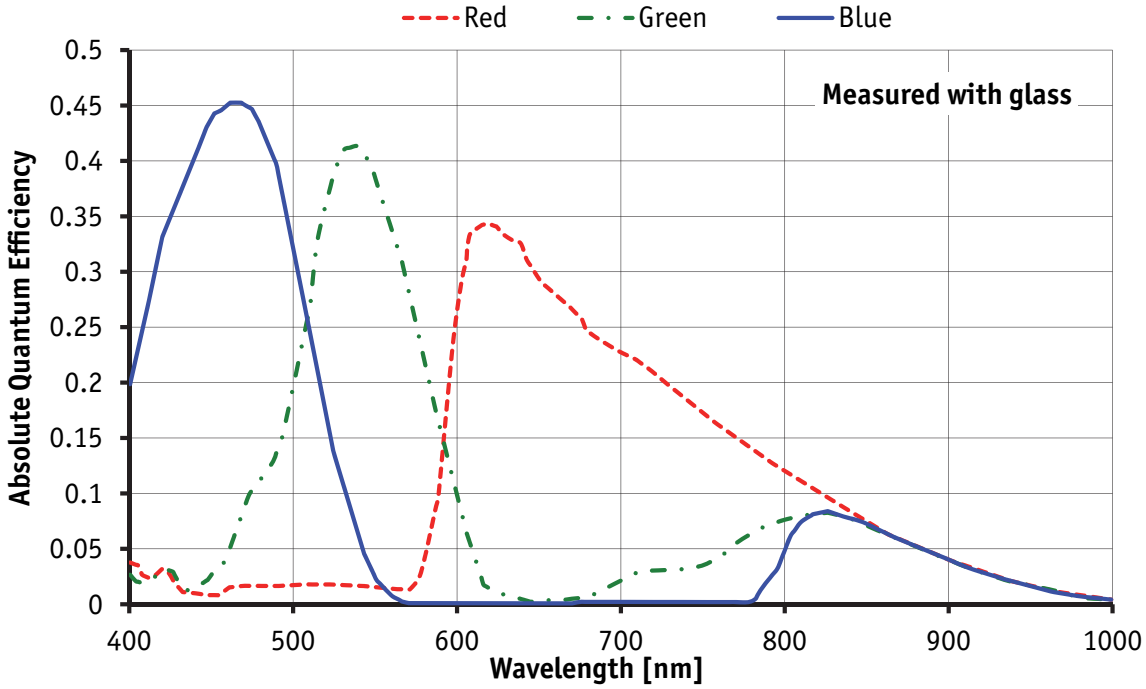


Figure 14: Prosilica GE2040C color spectral response (without IR cut filter)

Prosilica GE4000/4000C

Feature	Specification
Resolution	4008 x 2972
Sensor	Truesense KAI-11002
Type	CCD Progressive
Sensor size	35 mm
Cell size	9 µm
Lens mount	F
Max frame rate at full resolution	5 fps
A/D	12 bit
On-board FIFO	32 MB
Bit depth	8/12
Mono formats	GE4000: Mono8, Mono12, Mono12Packed
Color formats	BayerGR8, BayerGR12, BayerGR12Packed
Exposure control	140 µs to 68.7 s; 1 µs increments
Gain control	0 to 34 dB
Horizontal binning	1 to 8 pixels
Vertical binning	1 to full resolution
TTL I/Os	1 input, 3 output
RS-232	1
Power requirements	5–16 VDC: Cameras SN: 02-XXXX**A**-XXXXX, 02-XXXX**B**-XXXXX 5–25 VDC: Cameras SN: 02-XXXX**C**-XXXXX
Power consumption	Typical < 6 W (@ 12 VDC); (full resolution and maximal frame rates)
Mass	402 g (without lens)
Body dimensions (L x W x H)	110 x 66 x 66 mm (including connectors, w/o tripod and lens)
Operating temperature	0 to +50 °C ambient temperature (without condensation)
Storage temperature	-10 to +70 °C ambient temperature (without condensation)
Trigger latency	4.2 µs
Trigger jitter	±10 ns
tpd	90 ns
Operating humidity	20 to 80% non-condensing
Hardware interface standard	IEEE 802.3 1000BASE-T, 100BASE-TX
Software interface standard	GigE Vision Standard 1.2
Regulatory	CE, FCC Class A, RoHS (2011/65/EU)

Table 10: Prosilica GE4000/4000C camera specifications

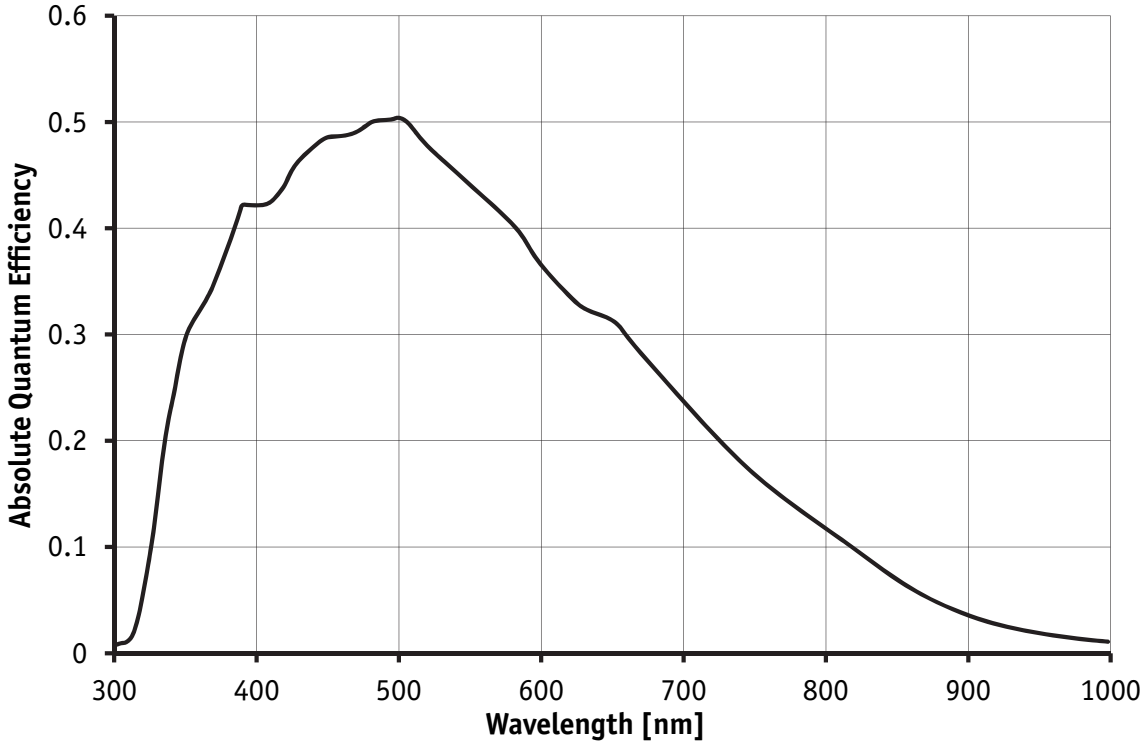


Figure 15: Prosilica GE4000 monochrome spectral response

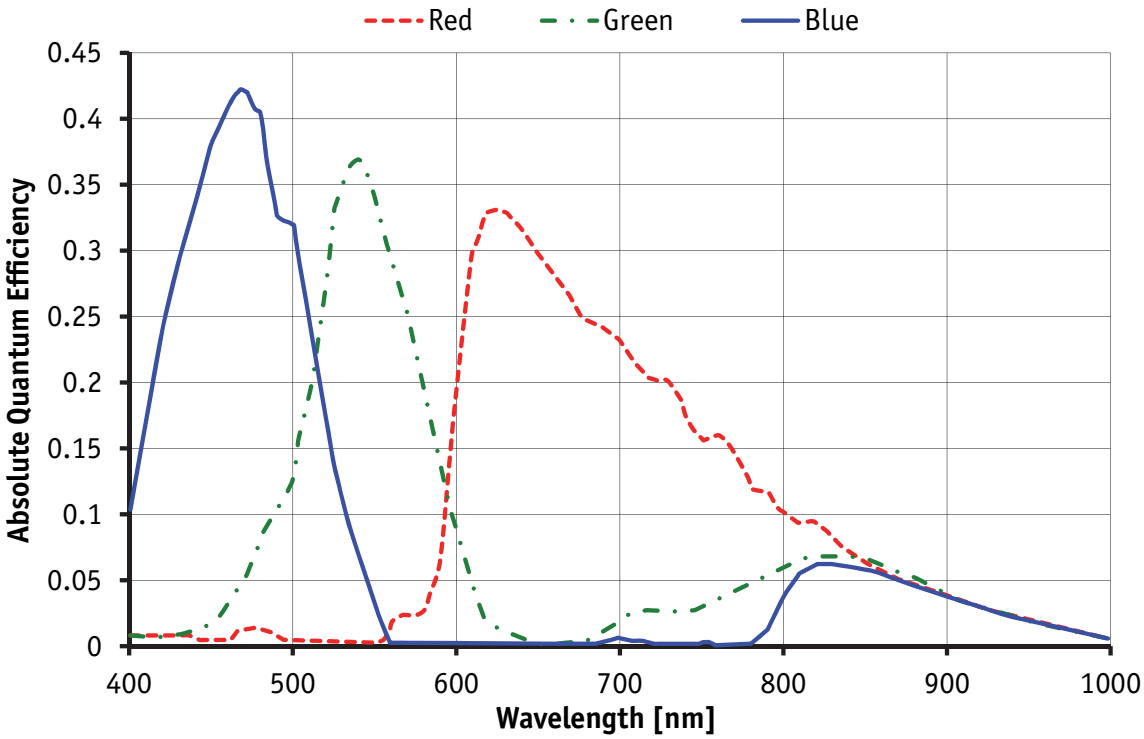


Figure 16: Prosilica GE4000C color spectral response (without IR cut filter)

Prosilica GE4900/4900C

Feature	Specification
Resolution	4872 x 3248
Sensor	Truesense KAI-16000
Type	CCD Progressive
Sensor size	35 mm
Cell size	7.4 µm
Lens mount	F
Max frame rate at full resolution	3 fps
A/D	12 bit
On-board FIFO	32 MB
Bit depth	8/12
Mono formats	GE4900: Mono8, Mono12, Mono12Packed
Color formats	BayerGR8, BayerGR12, BayerGR12Packed
Exposure control	625 µs to 68.7 s; 1 µs increments
Gain control	0 to 34 dB
Horizontal binning	1 to 8 pixels
Vertical binning	1 to full resolution
TTL I/Os	1 input, 3 output
RS-232	1
Power requirements	5–16 VDC: Cameras SN: 02-XXXX**A**-XXXXX, 02-XXXX**B**-XXXXX 5–25 VDC: Cameras SN: 02-XXXX**C**-XXXXX
Power consumption	Typical < 6 W (@ 12 VDC); (full resolution and maximal frame rates)
Mass	391 g (without lens)
Body dimensions (L x W x H)	110 x 66 x 66 mm (including connectors, w/o tripod and lens)
Operating temperature	0 to +50 °C ambient temperature (without condensation)
Storage temperature	-10 to +70 °C ambient temperature (without condensation)
Trigger latency	4.2 µs
Trigger jitter	±10 ns
tpd	90 ns
Operating humidity	20 to 80% non-condensing
Hardware interface standard	IEEE 802.3 1000BASE-T, 100BASE-TX
Software interface standard	GigE Vision Standard 1.2
Regulatory	CE, FCC Class A, RoHS (2011/65/EU)

Table 11: Prosilica GE4900/4900C camera specifications

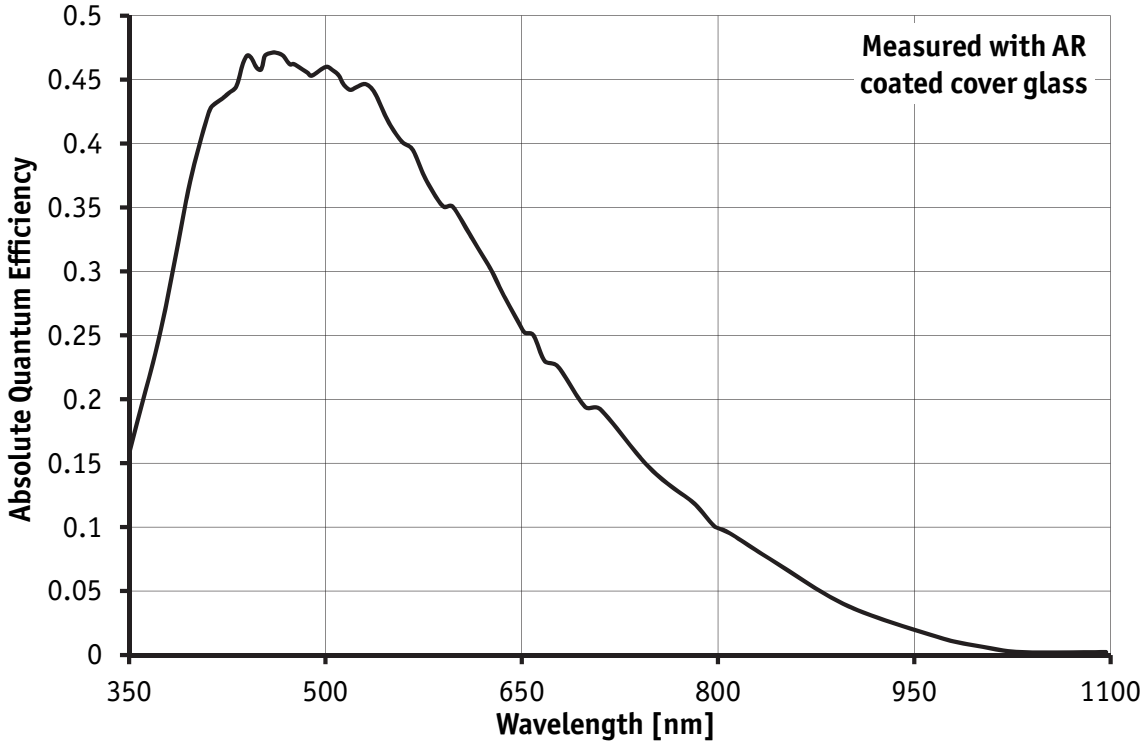


Figure 17: Prosilica GE4900 monochrome spectral response

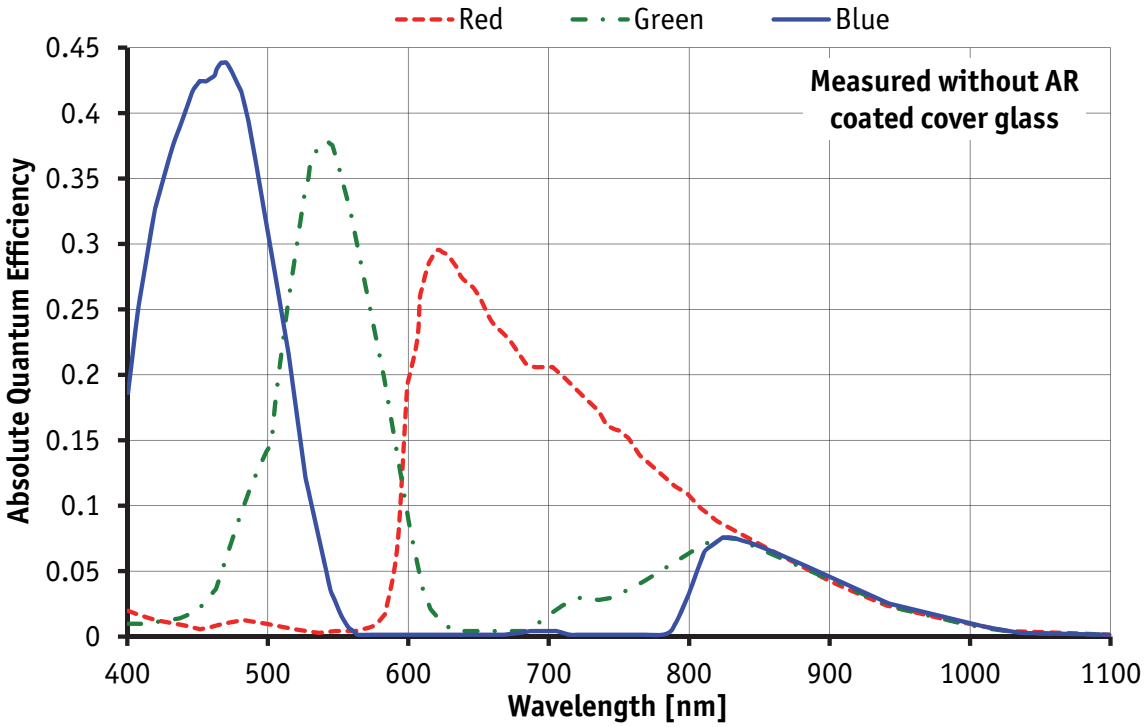


Figure 18: Prosilica GE4900C color spectral response (without IR cut filter)

Camera attribute highlights

AVT cameras support a number of standard and extended features. The table below identifies a selection of interesting capabilities of the Prosilica GE camera family.

www

A complete listing of camera controls, including control definitions can be found online:

PvAPI users: AVT GigE Camera and Driver Attributes document

VIMBA users: AVT GigE Camera and Driver Features document

Control	Description
Gain control	Manual and auto
Exposure control	Manual and auto
White balance	Red and blue channel; manual and auto control
External trigger event	Rising edge, falling edge, any edge, level high, level low
External trigger delay	0 to 60* s; 1 µs increments
Fixed rate control	0.001 fps to maximum frame rate
Imaging modes	Free-running, external trigger, fixed rate, software trigger
Sync out modes	Trigger ready, trigger input, exposing, readout, imaging, strobe, GPO
Region of interest	Independent x and y control with 1 pixel resolution
Multicast	Streaming to multiple computers
Event channel	In-camera events including exposure start and trigger are asynchronously broadcasted to the host computer
Chunk data	Captured images are bundled with attribute information such as exposure and gain value
*May vary depending on the camera model	

Table 12: Prosilica GE camera and driver attribute highlights

Filters

All Prosilica GE color models are equipped with an infrared block filter (IR filter). This filter is employed to prevent infrared wavelength photons from passing to the sensor. In the absence of IR filter, images are dominated by red and incapable of being properly color balanced. Monochrome cameras do not employ an IR filter.

The figure below shows the filter transmission response for the IRC30 filter employed in the Prosilica GE cameras.

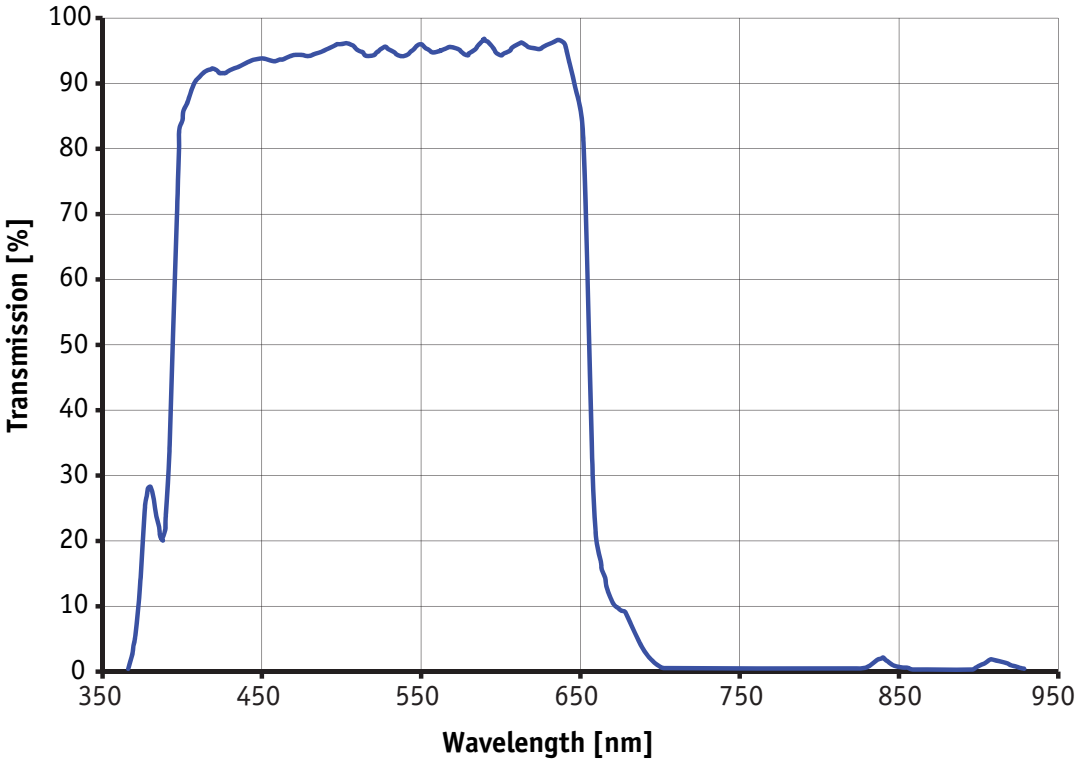


Figure 19: IRC30 filter transmission response

Camera dimensions

Prosilica GE C-Mount (adjustable)

GE680/680C, GE1050/1050C, GE1650/1650C, GE1660/1660C, GE1900/1900C, GE1910/1910C, GE2040/2040C

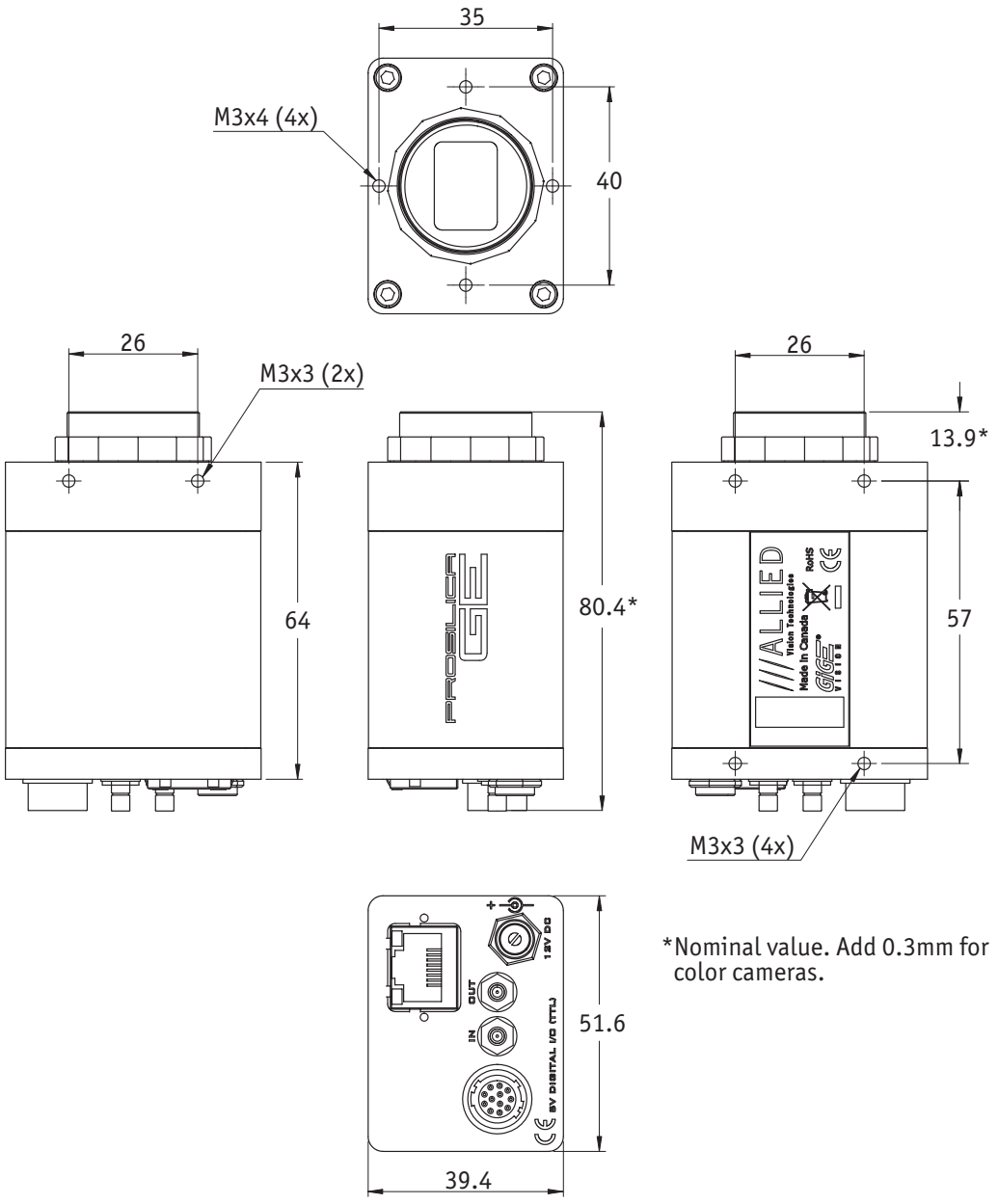


Figure 20: Prosilica GE adjustable C-Mount models mechanical dimensions

Prosilica GE F-Mount: GE2040/2040C

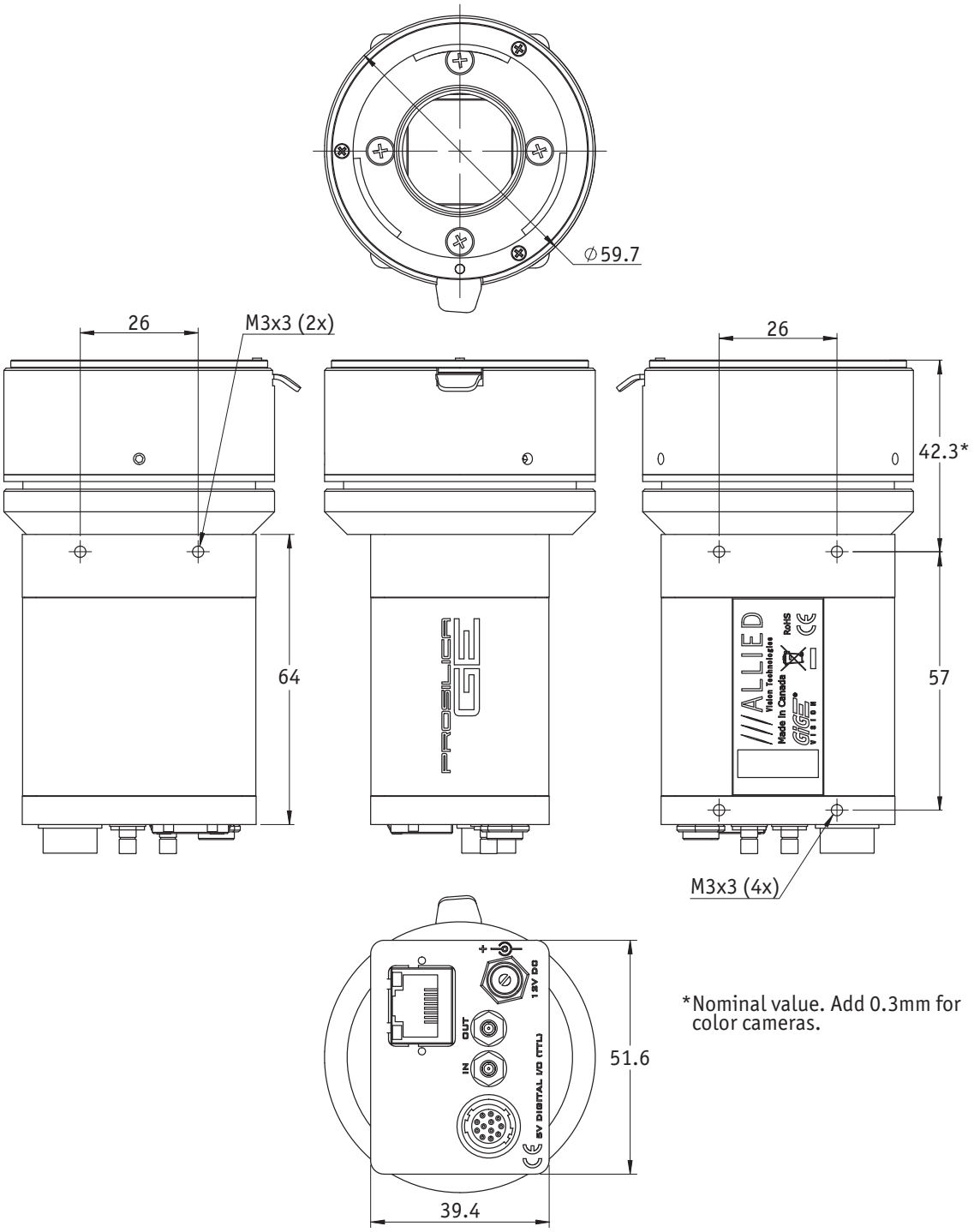


Figure 21: Prosilica GE F-Mount mechanical dimensions

Prosilica GE large format F-Mount: GE4000/ 4000C, GE4900/4900C

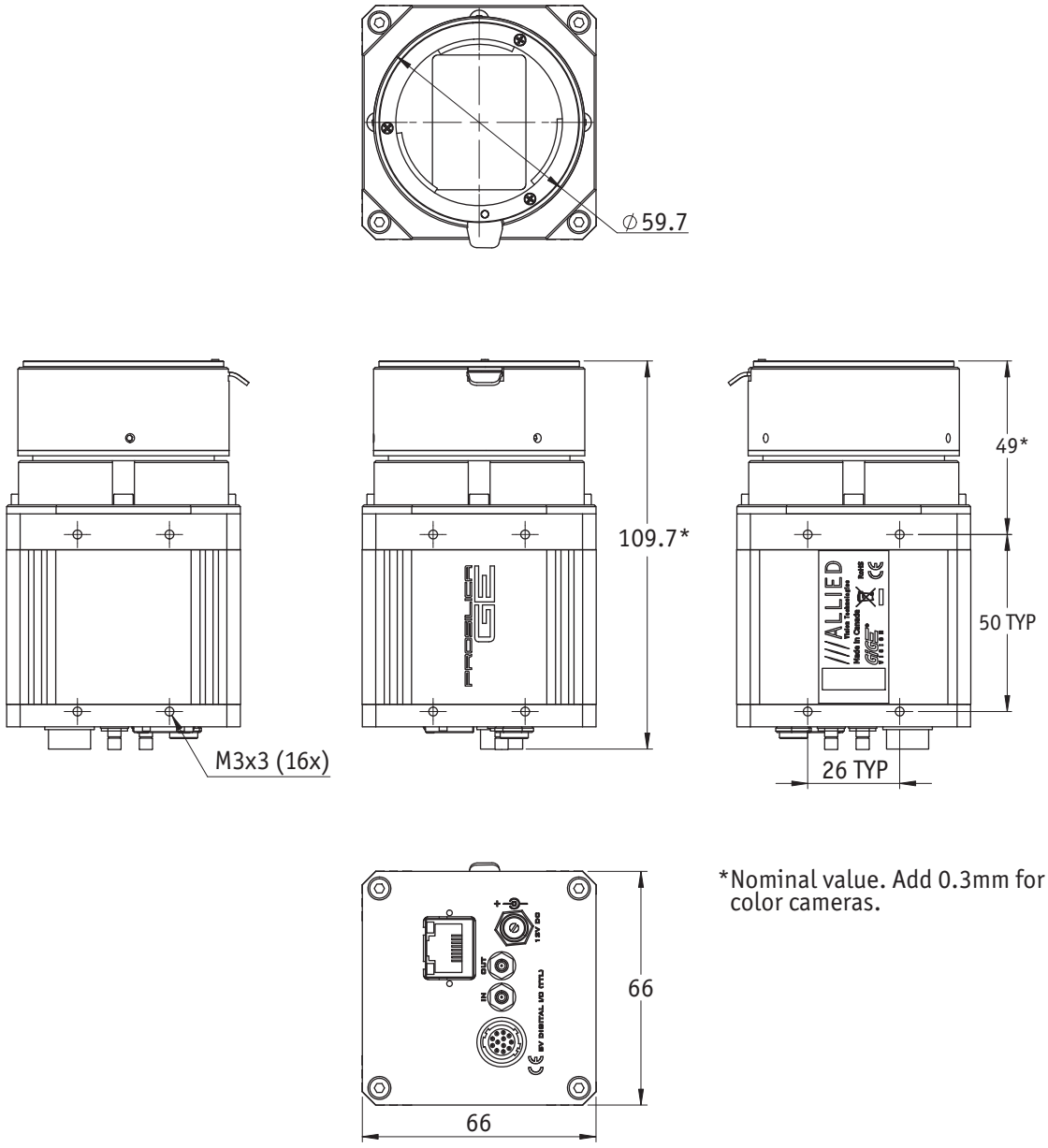


Figure 22: Prosilica GE large format F-Mount mechanical dimensions

Tripod adapter

A Prosilica GE camera can be mounted on a camera tripod by using a mounting plate P/N 02-5000A. The same mounting plate can be used for all models within the GE camera family.

Note

Prosilica GE tripod mount is available for purchase from AVT.

AVT P/N: 02-5000A

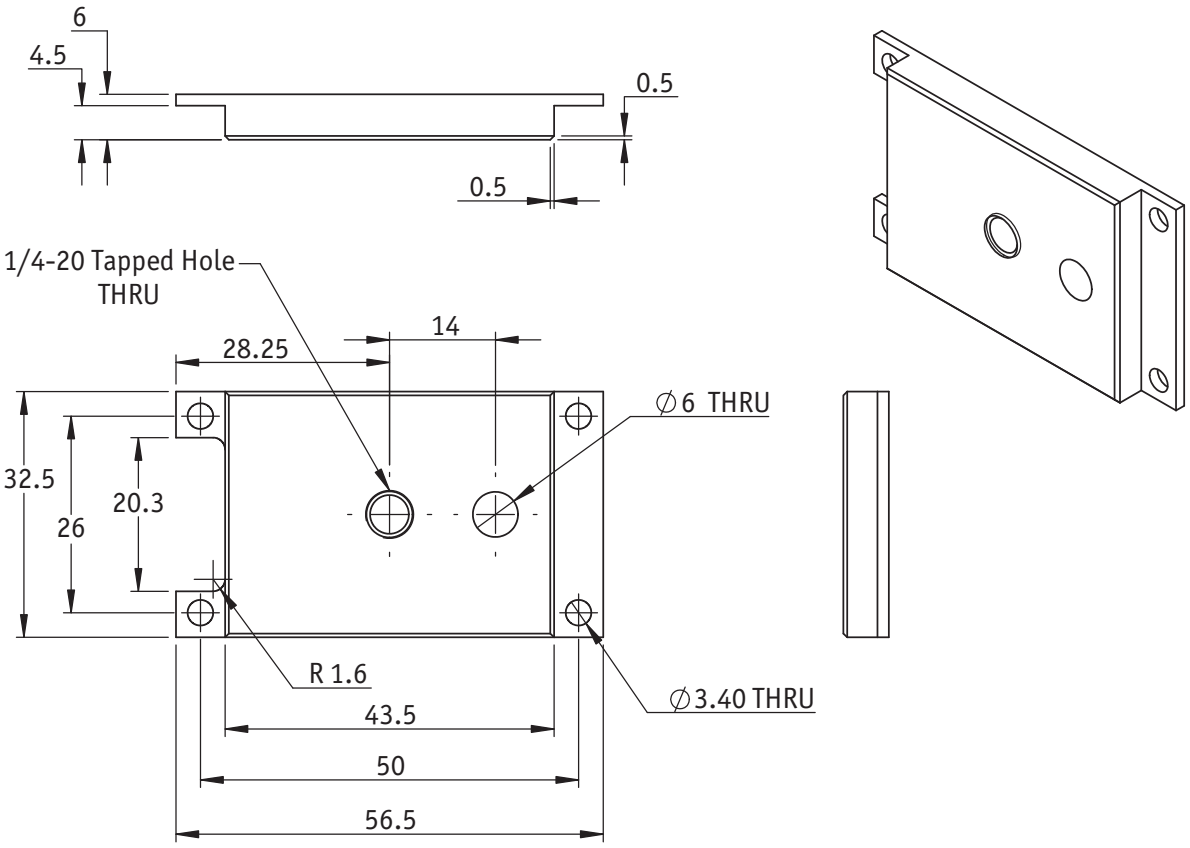


Figure 23: Prosilica GE tripod mount mechanical drawing

Optical flange focal distance

Optical flange focal distance is the optical distance from the mounting flange to the image sensor die (see figure 24 and figure 25). Optical flange focal distance can be calculated as:

$$\text{Optical flange focal distance} \approx \text{Flange focal distance} - \left(\frac{\text{IR cut filter thickness} + \text{Sensor window thickness}}{3}\right)$$

C-Mount cross section

Table 13 presents flange focal distance and maximum lens protrusion values for Prosilica GE cameras with C-Mount.

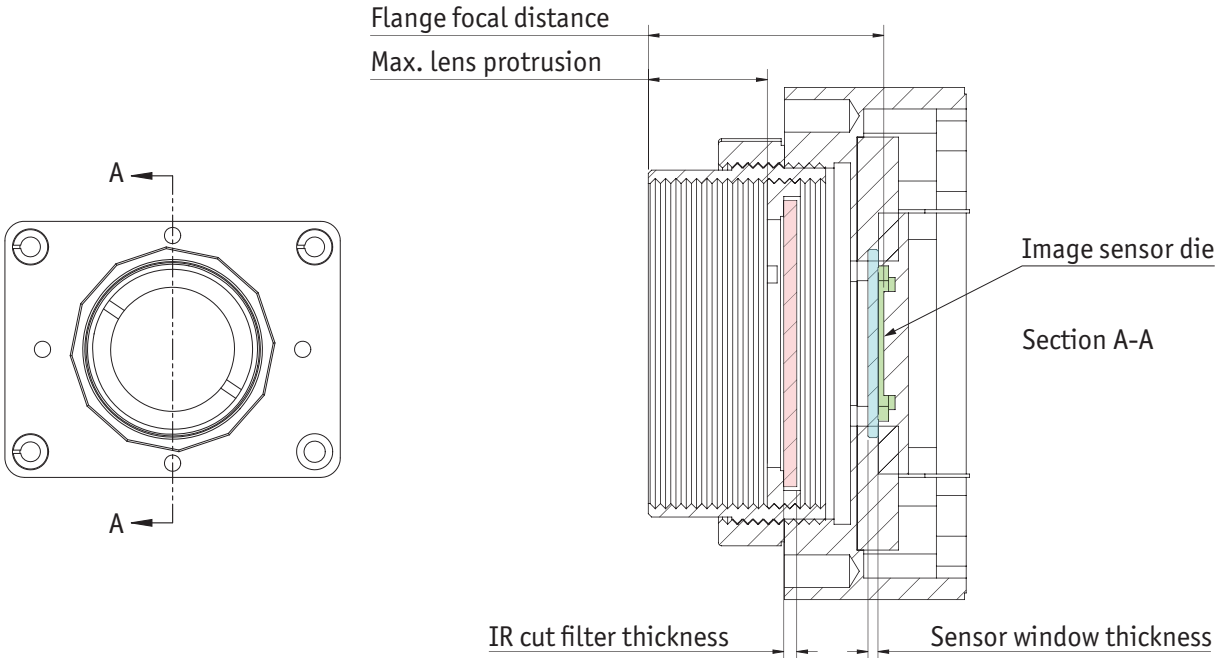


Figure 24: Cross section of typical Prosilica GE front assembly with C-Mount

Camera	Lens protrusion [mm]	IR cut filter* [mm]	Sensor window [mm]	Nominal flange focal distance [mm]
GE680	13.64	-	0.84	17.81
GE680C	9.01	1.00	0.84	18.14
GE1050	13.64	-	0.76	17.78
GE1050C	9.71	1.00	0.76	18.11
GE1650	13.64	-	0.76	17.78
GE1650C	9.20	1.00	0.76	18.11
GE1660	13.64	-	0.76	17.78

Table 13: Flange focal distance and maximum lens protrusion for Prosilica GE cameras with C-Mount

Camera	Lens protrusion [mm]	IR cut filter* [mm]	Sensor window [mm]	Nominal flange focal distance [mm]
GE1660C	9.67	1.00	0.76	18.11
GE1900	13.64	-	0.76	17.78
GE1900C	9.15	1.00	0.76	18.11
GE1910	13.64	-	0.76	17.78
GE1910C	9.67	1.00	0.76	18.11
GE2040	13.64	-	0.89	17.82
GE2040C	13.64	1.00	0.89	18.16
*Only color Prosilica GE cameras are equipped with IR cut filter.				

Table 13: Flange focal distance and maximum lens protrusion for Prosilica GE cameras with C-Mount

F-Mount cross section

Table 14 presents flange focal distance values for Prosilica GE cameras with F-Mount.

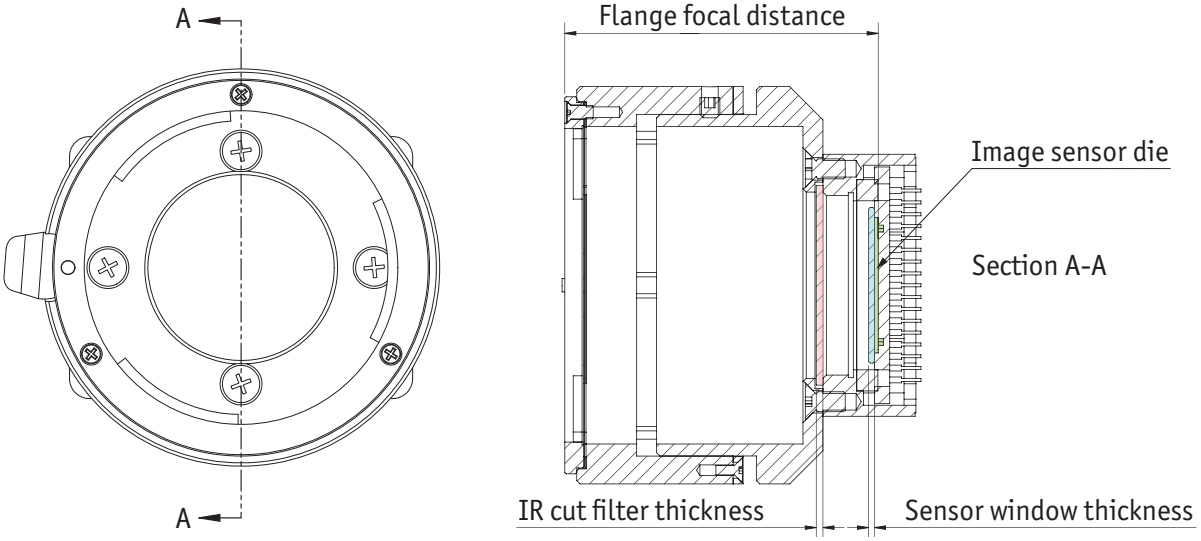


Figure 25: Cross section of typical Prosilica GE front assembly with F-Mount

Camera	IR cut filter* [mm]	Sensor window [mm]	Nominal flange focal distance [mm]
GE2040	-	0.89	46.80
GE2040C	1.00	0.89	47.13
GE4000	-	0.89	46.80
GE4000C	1.50	0.89	47.30
GE4900	-	0.81	46.77
GE4900C	1.50	0.81	47.27
*Only color Prosilica GE cameras are equipped with IR cut filter.			

Table 14: Flange focal distance for Prosilica GE cameras with F-Mount

Adjustment of C-Mount

www

Prosilica GE cameras are shipped with an adjustable C-Mount, F-Mount, or CS-Mount depending on sensor size and camera order code. **See AVT Modular Concept** for more information:

http://www.alliedvisiontec.com/us/support/downloads/product-literature/avt-modular-concept.html

The C-Mount or CS-Mount is adjusted at the factory and should not require adjusting. If for some reason the lens mount requires adjustment, use the following method.

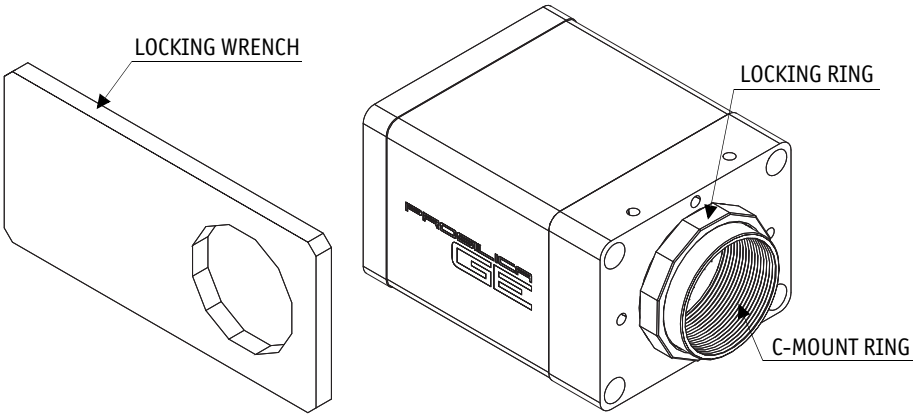


Figure 26: Prosilica GE C-Mount camera and locking wrench

Loosen locking ring

Use an adjustable wrench to loosen the locking ring. Be careful not to scratch the camera. When the locking ring is loose, unthread the ring a few turns from the camera face.

Note

A wrench suitable for this procedure is available for purchase from AVT.
AVT P/N: 02-5003A

Image to infinity

Use a C-Mount compatible lens (CS-Mount compatible lens, if using CS ring) that allows an infinity focus. Set the lens to infinity and image a distant object—10 to 15 m should suffice. Make sure the lens is firmly threaded onto the C-Mount ring. Rotate the lens and C-Mount ring until the image is focused. Carefully tighten the locking ring and recheck focus.

Adjustment of F-Mount

The F-Mount is adjusted at the factory and should not require adjusting. If for some reason, the lens mount requires adjustment, use the following method.

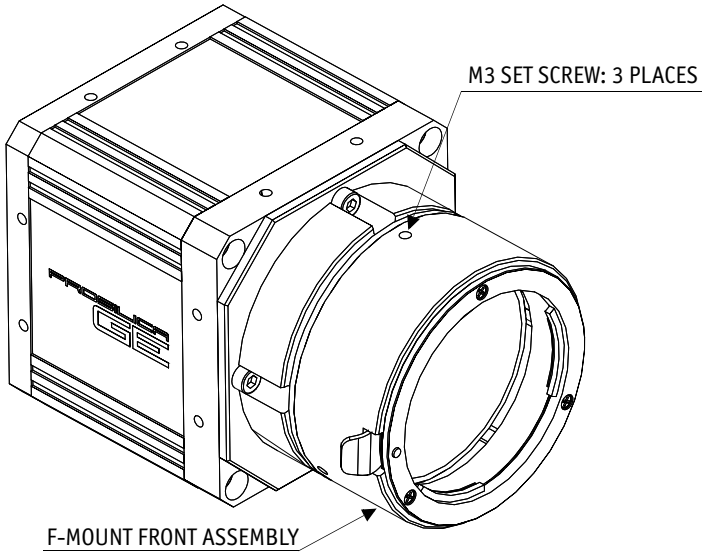


Figure 27: Prosilica GE F-Mount isometric view

Attach F-Mount compatible lens

Use an F-Mount compatible lens that allows an infinity focus. Attach the lens to the camera using a counter-clockwise rotation of about a quarter turn. The lens should snap into place such that the lens flange and camera flange mate over the full circumference.

Loosen F-Mount front assembly

Use a 1.5 mm hex wrench to loosen the 3 set screws than hold the F-Mount front assembly to the camera body.

Image to infinity

Set the lens to infinity and image a distant object—10 to 15 m should suffice. Gently move the F-Mount front until focused and lock it in place.

Camera interfaces

This chapter provides information on Gigabit Ethernet port, inputs and outputs, and trigger features.

www

For more information on GigE accessories:
http://www.alliedvisiontec.com/emea/products/accessories/gige-accessories.html

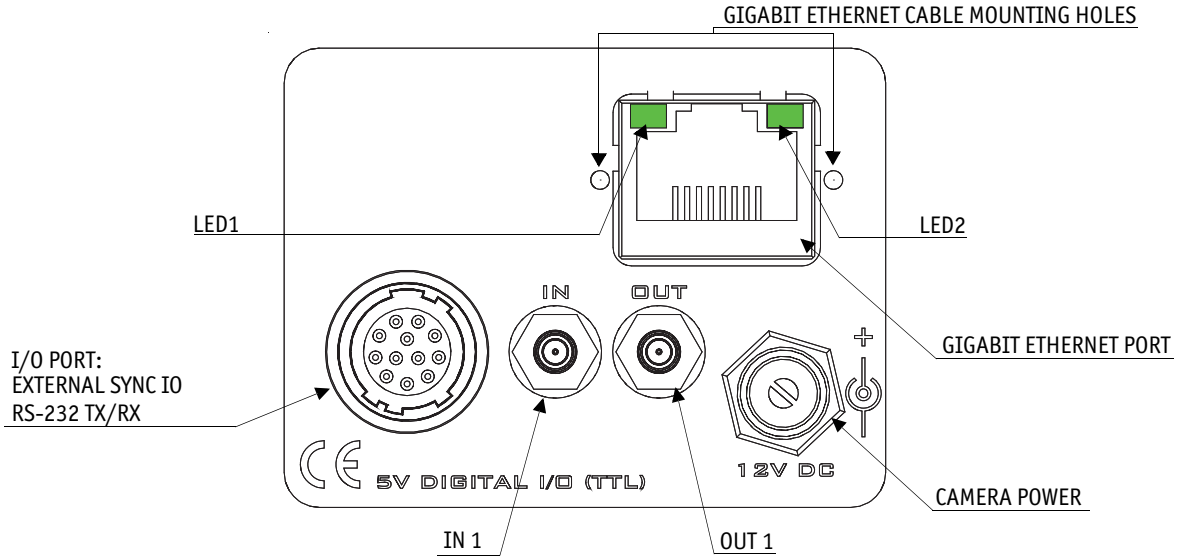


Figure 28: Prosilica GE connection ports

Status LEDs

The color of the LEDs have the following meaning:

	LED color	Status
LED1	Flashing/solid green	Ethernet activity
LED2	Flashing green	Camera is powered
	Solid green	Camera is booted, and link with the host is established

Table 15: Status of LEDs in Prosilica GE

Note

Once the camera is booted, LED2 will remain solid green as long as the camera is powered, even if connection with the host is lost.

Gigabit Ethernet port

The Gigabit Ethernet port conforms to the IEEE 802.3 1000BASE-T standard for Gigabit Ethernet over copper. AVT recommends using Category 6 or higher compatible cabling and connectors for best performance.

www

The **AVT GigE Installation Manual** offers detailed instructions for using Prosilica GE cameras.

http://www.alliedvisiontec.com/fileadmin/content/PDF/Products/Technical_Manual/GigE_Install_Manual/AVT_GigE_Installation_Manual.pdf

www

See **Hardware Selection for AVT GigE Cameras** application note for a list of recommended Ethernet adapters

http://www.alliedvisiontec.com/fileadmin/content/PDF/Support/Application_Notes/Hardware_Selection_for_AVT_GigE_Cameras.pdf

Note

A standard Ethernet adapter is available for purchase from AVT:
AVT P/N: 02-3002A
Model: Intel Pro 1000/PT

Note

Cable lengths up to 100 m are supported.

The 8-pin RJ-45 jack has the pin assignment according to the Ethernet standard (IEEE 802.3 1000BASE-T).

Cables with screw-lock connectors are available for purchase from AVT:

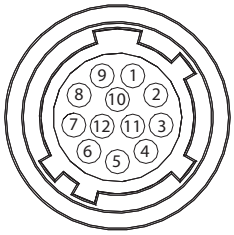
http://www.alliedvisiontec.com/emea/products/accessories/gige-accessories.html

Note

Prosilica GE cameras support cables with horizontal locking screw connector for a secured connection (See figure 28).

AVT recommends using locking-screw cables from Components Express, Inc. for a perfect fit. Visit the CEI product configurator to customize the cable according to your needs.

Camera I/O connector pin assignment



Pin	Signal	Direction	Level	Description
1	In 1	In	TTL max. 5 V	Camera input galvanic isolated (SyncIn1)
2	Out 2	Out	TTL max. 5 V	Camera output 2 galvanic isolated (SyncOut2)
3	Out 3	Out	TTL max. 5 V	Camera output 3 galvanic isolated (SyncOut3)
4	RxD RS-232	In	RS-232	Terminal receive data
5	TxD RS-232	Out	RS-232	Terminal transmit data
6	Reserved	---	---	---
7	Reserved	---	---	---
8	Reserved	---	---	---
9	Reserved	---	---	---
10	Isolated IO GND	In/Out	Common GND for In/Out	Isolated input and output signal ground
11	Isolated IO GND	In/Out	Common GND for In/Out	Isolated input and output signal ground
12	Isolated IO GND	In/Out	Common GND for In/Out	Isolated input and output signal ground

Figure 29: Camera I/O connector pin assignment

The general purpose I/O port uses a Hirose HR10A-10R-12SB connector on the camera side. The mating cable connector is Hirose HR10A-10P-12P.

Note

This cable side Hirose connector can be purchased from AVT.
AVT P/N: K7600039

I/O definition

Camera power

The Prosilica GE camera family supports a wide input power voltage range. The camera will not power in reverse polarity. Exceeding the voltage range specified below will damage the camera.

Caution 5–24 V. 12 V nominal.

Note A 12 V power adapter with barrel connector is available for purchase from AVT:

- P/N 02-8005C North America Supply.
- P/N 02-8010C Universal Supply.

Isolated IO GND

Isolated IO GND must be connected to the user's external circuit ground if In 1, Out 1, Out 2, Out 3, RxD RS-232, and TxD RS-232 is to be used. Note that Isolated IO GND is common with power ground; however, it is good practice to provide a separate ground connection for power and signaling when designing the cabling.

RxD RS-232 and TxD RS-232

These signals are RS-232 compatible. These signals allow communication from the host system via the Ethernet port to a peripheral device connected to the camera. Note that these signals are not isolated; therefore, cabling should be carefully designed for the noisy environments.

Input triggers

In 1

In 1 allows the camera to be synchronized to an external event. The camera can be programmed to trigger on the rising edge, falling edge, both edges, or level of this signal. The camera can also be programmed to capture an image at some programmable delay time after the trigger event.

Caution **Do not exceed 5.5 V on In 1.**

The Mini-SMB trigger input is internally connected to the In 1 of the general purpose I/O port. The Mini-SMB port on the camera uses an Amphenol 903-406J-51R connector. A suitable mating cable connector is Amp 413985-3 which can be used with RG174 coaxial cable.

Note SMB to SMB cables is available for purchase from AVT with various lengths. The 3 meter length uses the following:

P/N 02-6007A

Output signals

Out 1

This Mini-SMB trigger output is NOT internally connected to other camera output pins of the Camera I/O connector described above. This connector is particularly useful for triggering multiple cameras in a “daisy chain” fashion. It can be configured as follows:

Exposing	Corresponds to when camera is integrating light
Trigger Ready	Indicates when the camera will accept a trigger signal
Trigger Input	A relay of the trigger input signal used to “daisy chain” the trigger signal for multiple cameras
Readout	Valid when camera is reading out data
Imaging	Valid when camera is exposing or reading out
Strobe	Programmable pulse based on one of the above events
GPO	User programmable binary output

Any of the above signals can be set for active high or active low. The Mini-SMB port on the camera uses an Amphenol 903-406J-51R connector. A suitable mating cable connector is Amp 413985-3 which can be used with RG174 coaxial cable.

Note SMB to BNC cables is available for purchase from AVT.

P/N 02-6014A

Out 2 and Out 3

Out 2 and Out 3 can be configured to active high or active low. The internal camera signals are listed as follows:

Exposing	Corresponds to when camera is integrating light
Trigger Ready	Indicates when the camera will accept a trigger signal
Trigger Input	A relay of the trigger input signal used to “daisy chain” the trigger signal for multiple cameras
Readout	Valid when camera is reading out data
Imaging	Valid when camera is exposing or reading out
Strobe	Programmable pulse based on one of the above events
GPO	User programmable binary output

Video iris

This signal can be used to drive the video input of a video iris lens.

Reserved

These signals are reserved for future use and should be left disconnected.

Camera I/O connector internal circuit diagram

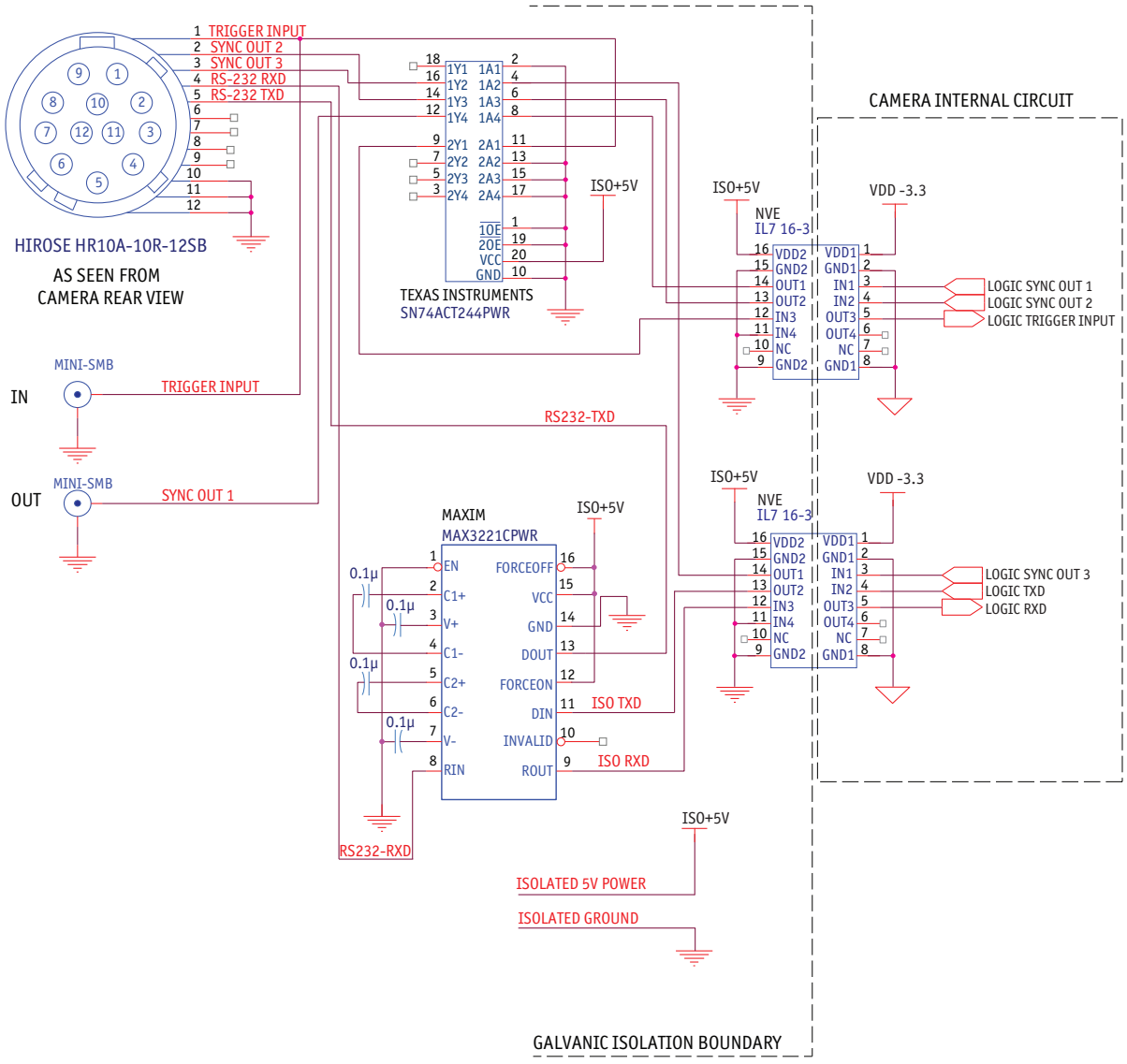


Figure 30: Prosilica GE internal circuit diagram

Maxim MAX3221CPWR

Used to drive the RS232 signal logic via the external connector.

Texas Instruments SN74ACT244PWR

Used as trigger buffer/driver. The required trigger input current is less than 10 µA and the maximum sync output current is 24 mA.

Camera I/O connector external circuit example

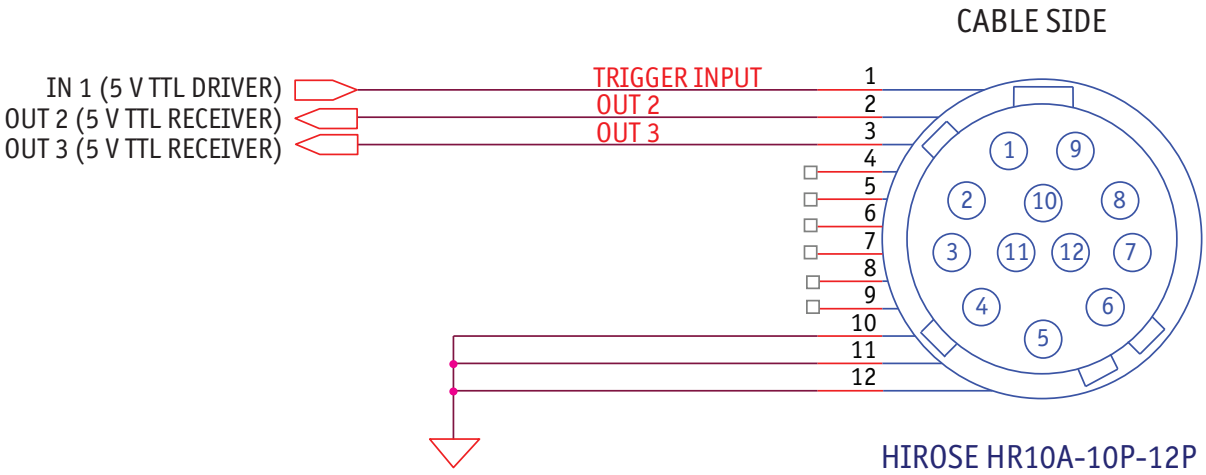


Figure 31: Prosilica GE external circuit

The trigger circuit is connected to a Texas Instruments SN74ACT244PWR buffer/driver inside the camera.

Caution

Input: Incoming trigger must be able to source 10 µA.

Output: Sync output current is 24 mA.

In 1, Out 1 external circuit example

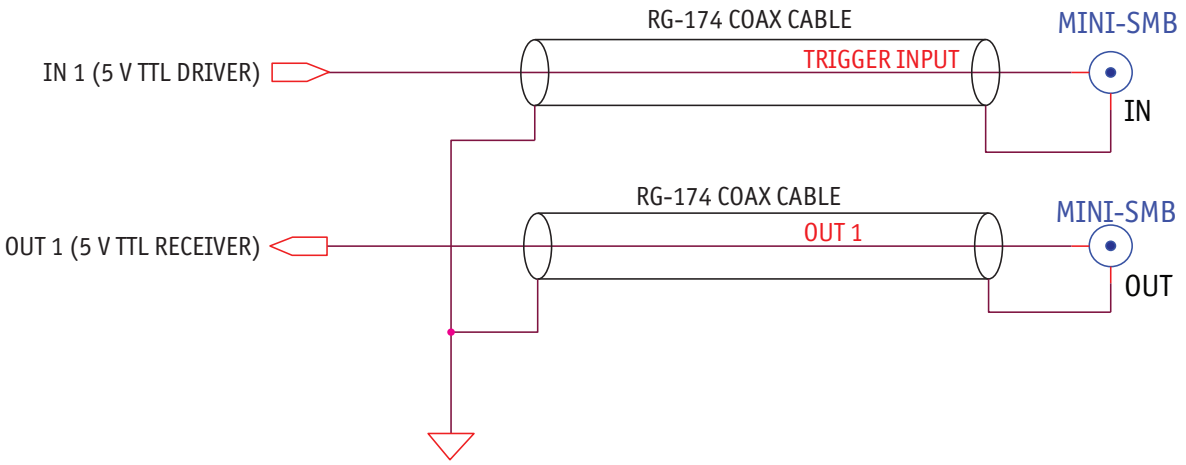


Figure 32: Prosilica GE In 1, Out 1 external circuit

The trigger circuit is connected to a Texas Instruments SN74ACT244PWR buffer/driver inside the camera. Note that the trigger input signal is not terminated to match the cable impedance.

Caution

Input: The required trigger input current is less than 10 µA.

Output: The maximum sync output current is 24 mA.

Trigger timing diagram

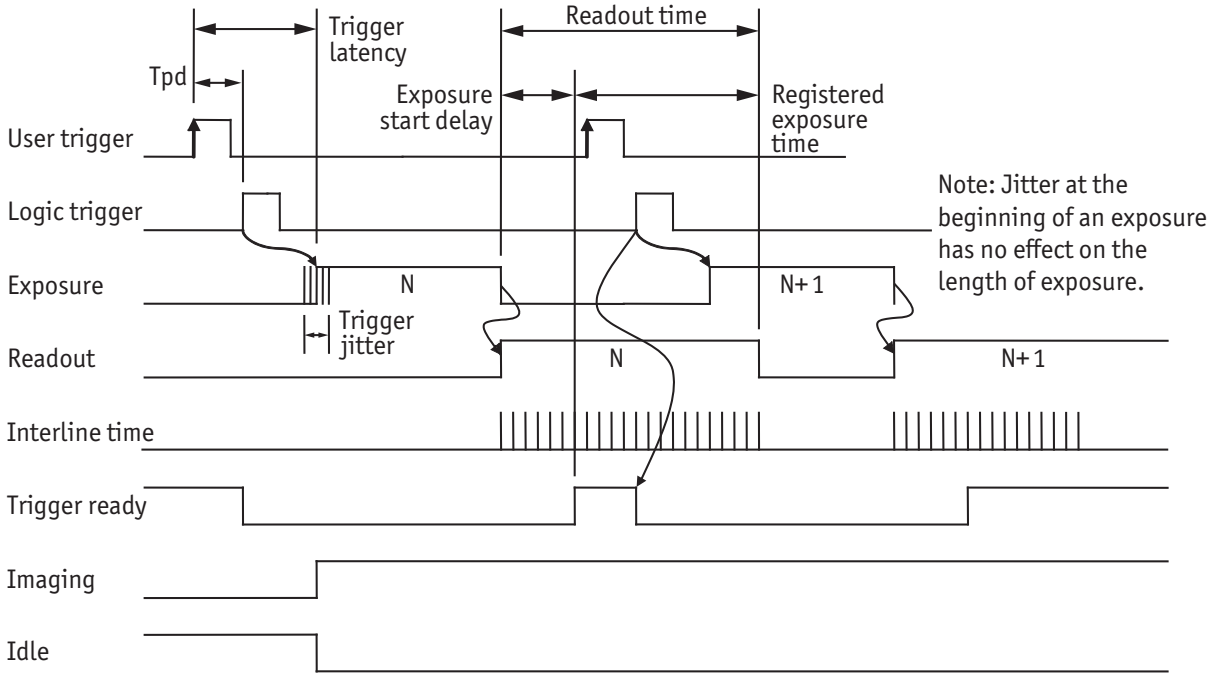


Figure 33: Prosilica GE internal signal timing waveforms

Notes on triggering

Term	Definition
User trigger	Trigger signal applied by the user (hardware trigger, software trigger)
Logic trigger	Trigger signal seen by the camera internal logic (not visible to the user)
Tpd	Propagation delay between the user trigger and the logic trigger
Exposure	High when the camera image sensor is integrating light
Readout	High when the camera image sensor is reading out data
Trigger latency	Time delay between the user trigger and the start of exposure
Trigger jitter	Error in the trigger latency time

Table 16: Explanation of signals in timing diagram

Term	Definition
Trigger ready	Indicates to the user that the camera will accept the next trigger
Registered exposure time	Exposure time value currently stored in the camera memory
Exposure start delay	Registered exposure time subtracted from the read-out time and indicates when the next exposure cycle can begin such that the exposure will end after the current readout
Interline time	Time between sensor row readout cycles
Imaging	High when the camera image sensor is either exposing and/or reading out data
Idle	High if the camera image sensor is not exposing and/or reading out data

Table 16: Explanation of signals in timing diagram

Trigger rules

Note

The **user trigger pulse width** should be at least three times the width of the trigger latency as indicated in Chapter Specifications on page 12.

- The **end of exposure** will always trigger the next readout.
- The **end of exposure** must always end after the current readout.
- The **start of exposure** must always correspond with the interline time if readout is true.
- **Exposure start delay** equals the readout time minus the registered exposure time.

Triggering during the idle state

For applications requiring the shortest possible *Trigger Latency* and the smallest possible *Trigger Jitter* the *User Trigger* signal should be applied when *Imaging* is false and *Idle* is true. In this case, *Trigger Latency* and *Trigger Jitter* are as indicated in the camera specifications.

Triggering during the readout state

For applications requiring the fastest triggering cycle time whereby the camera image sensor is exposing and reading out simultaneously, apply the *User Trigger* signal as soon as a valid *Trigger Ready* is detected. In this case, *Trigger Latency* and *Trigger Jitter* can be up to 1 row time since *Exposure* must always begin on an *Interline* boundary.

Firmware update

Firmware updates are carried out via the GigE connection. AVT provides an application for all Prosilica GE cameras that loads firmware to the camera using a simple interface. New feature introductions and product improvements motivate new firmware releases. All users are encouraged to use the newest firmware available and complete the firmware update if necessary.

www

Download the latest GigE firmware loader from the AVT website:

http://www.alliedvisiontec.com/us/support/downloads/firmware.html

www

For more information on GigE firmware update:

http://www.alliedvisiontec.com/fileadmin/content/PDF/Support/Application_Notes/AppNote_-_GigE_Firmware_Update.pdf

Resolution and ROI frame rates

This section provides the performance information which identifies the impact of reducing the region of interest on the camera's maximum frame rate.

Note

- Frame rate data was generated using **StreamBytesPerSecond = 124 MB/s** and an 8 bit pixel format such as Mono8, BayerGR8, or BayerRG8. Frame rates may be lower if using network hardware incapable of 124 MB/s.
- The camera frame rate can be increased by reducing the camera's Height attribute, resulting in a decreased region of interest (ROI) or "window".
- The camera frame rate can also be increased by increasing the camera's BinningY attribute, resulting in a vertically scaled image (less overall height with same field of view).
- There is no frame rate increase with reduced width.

Prosilica GE680

$$\text{Frame rate} = \frac{1}{9.49\ \mu s \times \text{Height} + 320.06\ \mu s}$$

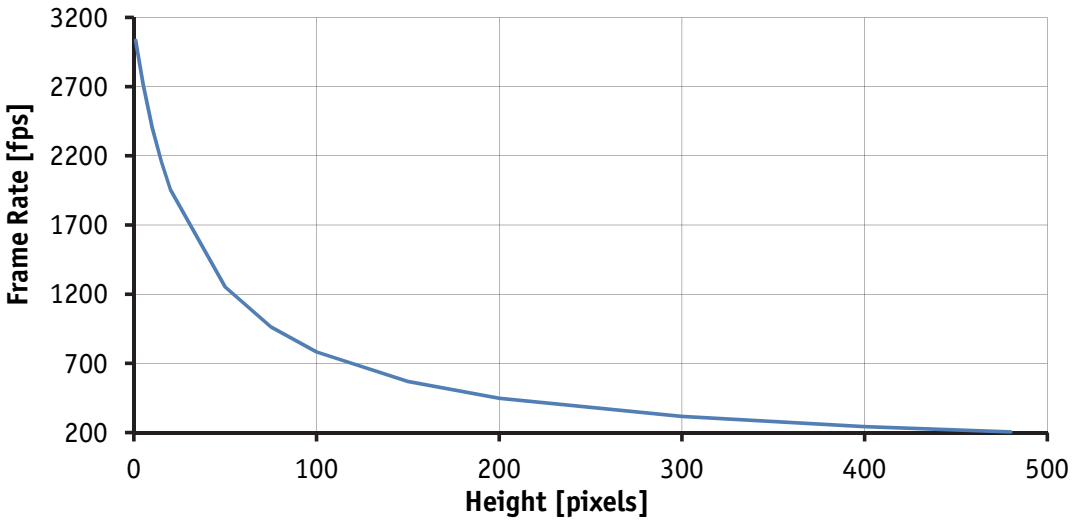


Figure 34: Frame rate vs. height for Prosilica GE680

Prosilica GE1050

$$\text{Frame rate} = \frac{1}{11.72\ \mu s \times \text{Height} + 4948.66\ \mu s}$$

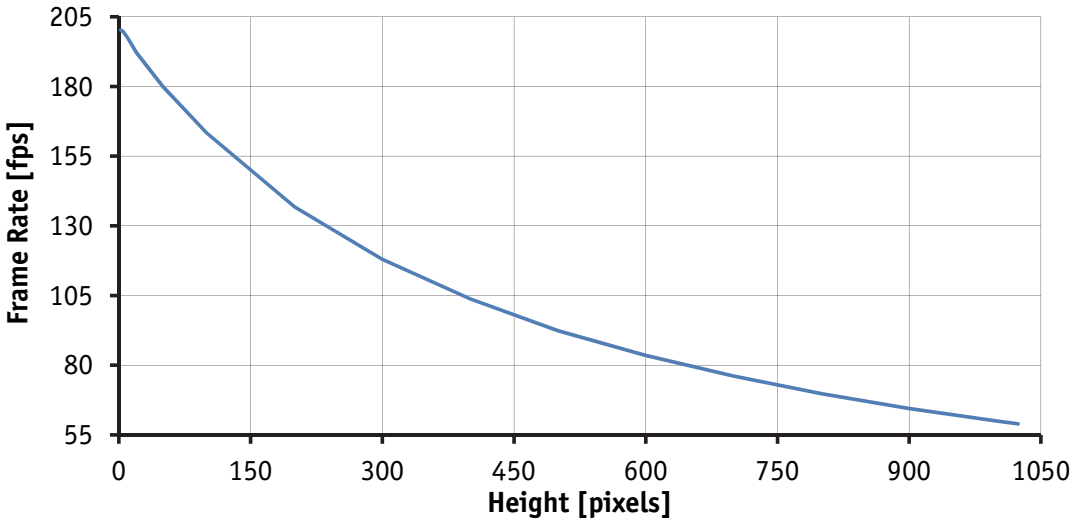


Figure 35: Frame rate vs. height for Prosilica GE1050

Prosilica GE1650

$$\text{Frame rate} = \frac{1}{17.61\ \mu s \times \text{Height} + 10119.0\ \mu s}$$

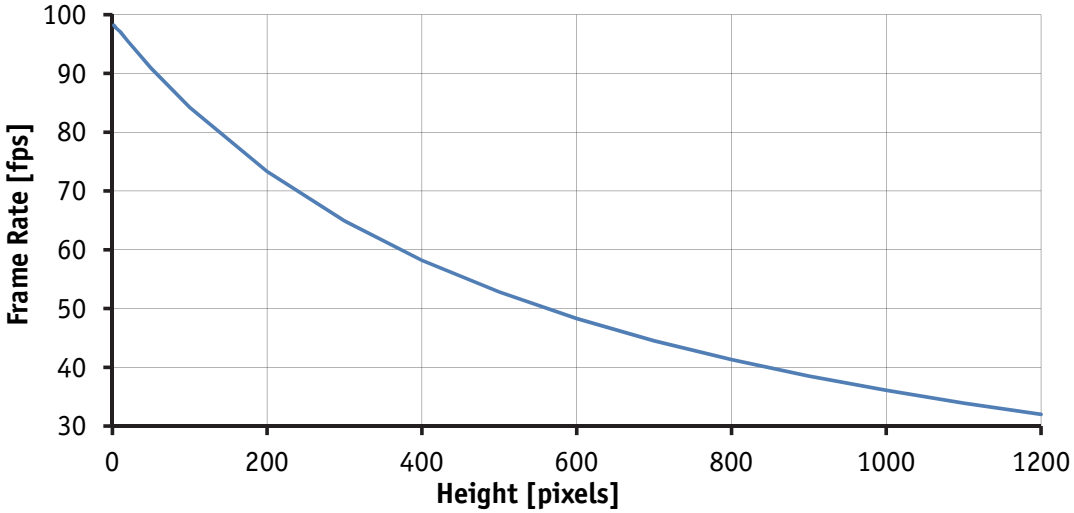


Figure 36: Frame rate vs. height for Prosilica GE1650

Prosilica GE1660

$$\text{Frame rate} = \frac{1}{17.99\ \mu s \times \text{Height} + 7398.16\ \mu s}$$

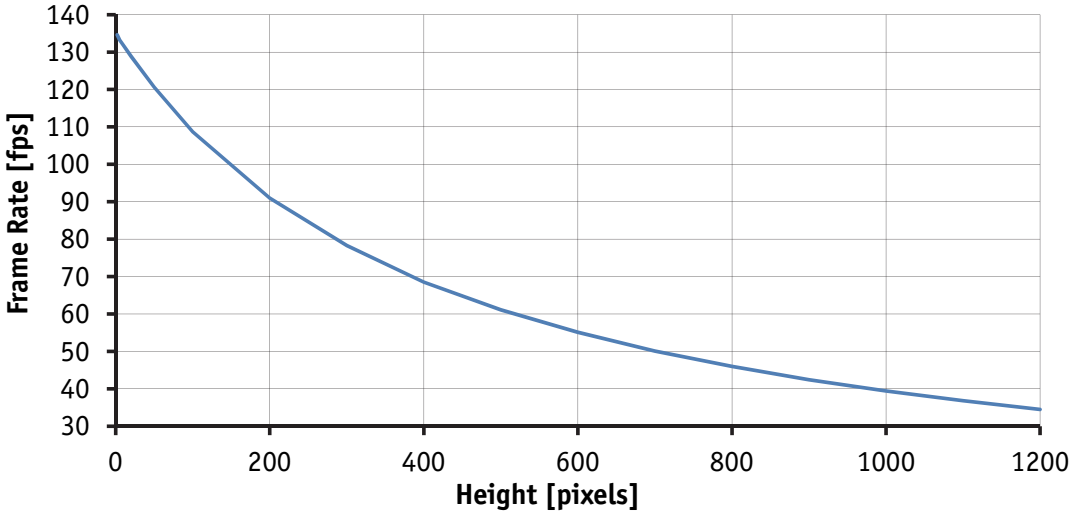


Figure 37: Frame rate vs. height for Prosilica GE1660

Prosilica GE1900

$$\text{Frame rate} = \frac{1}{18.31\ \mu s \times \text{Height} + 13114.72\ \mu s}$$

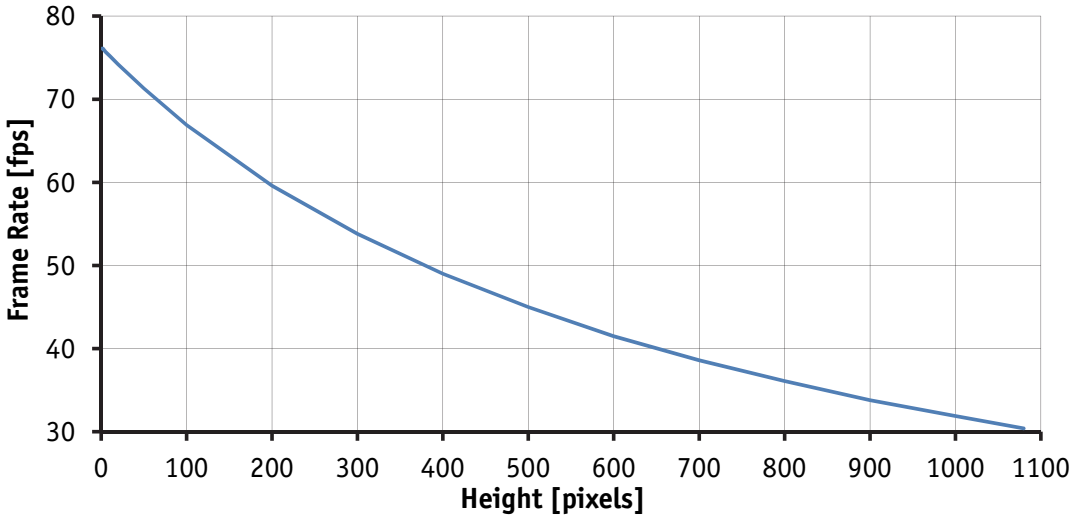


Figure 38: Frame rate vs. height for Prosilica GE1900

Prosilica GE1910

$$\text{Frame rate} = \frac{1}{21.35\ \mu s \times \text{Height} + 7526.47\ \mu s}$$

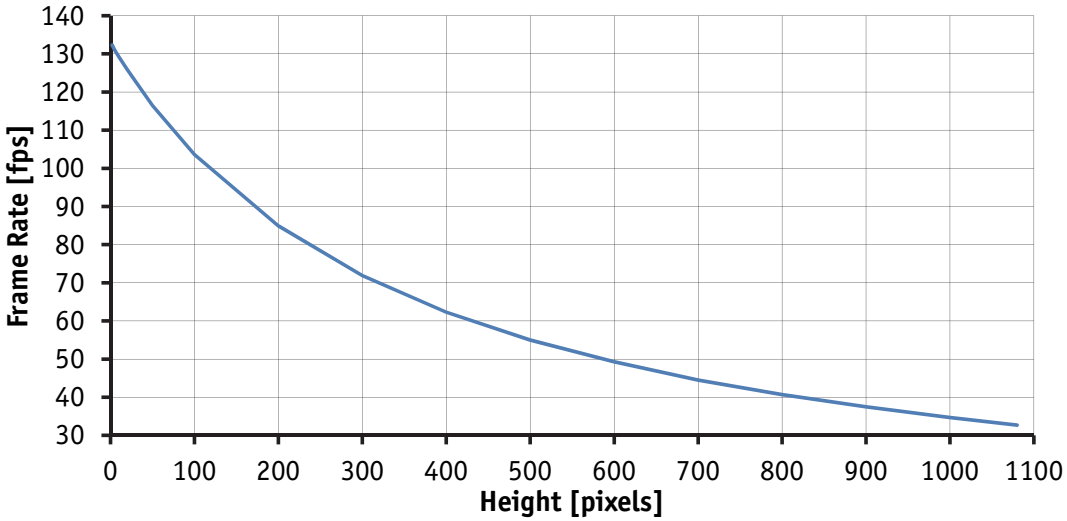


Figure 39: Frame rate vs. height for Prosilica GE1910

Prosilica GE2040

$$\text{Frame rate} = \frac{1}{15.63\ \mu s \times \text{Height} + 33773.85\ \mu s}$$

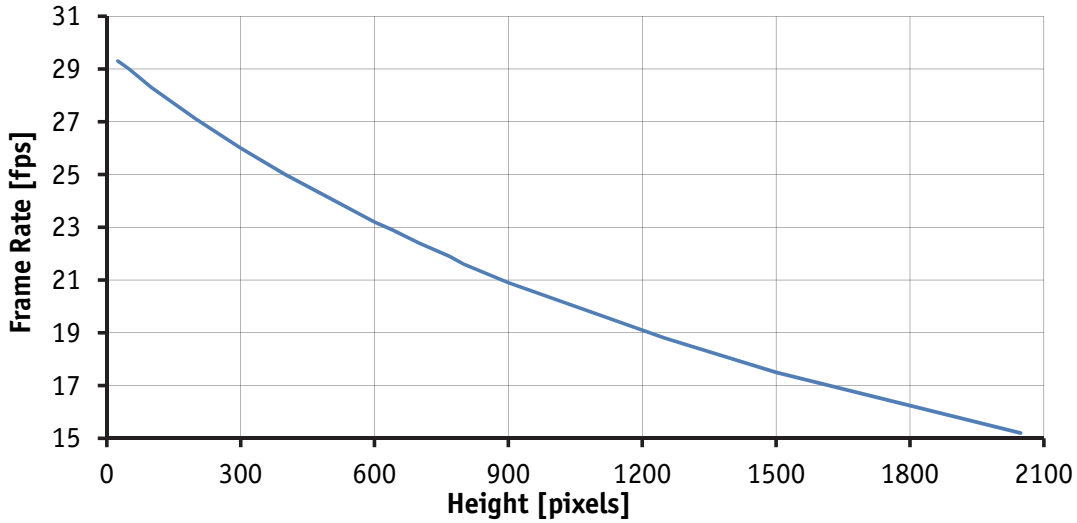


Figure 40: Frame rate vs. height for Prosilica GE2040

Prosilica GE4000

$$\text{Frame rate} = \frac{1}{52.45\ \mu s \times \text{Height} + 56713.22\ \mu s}$$

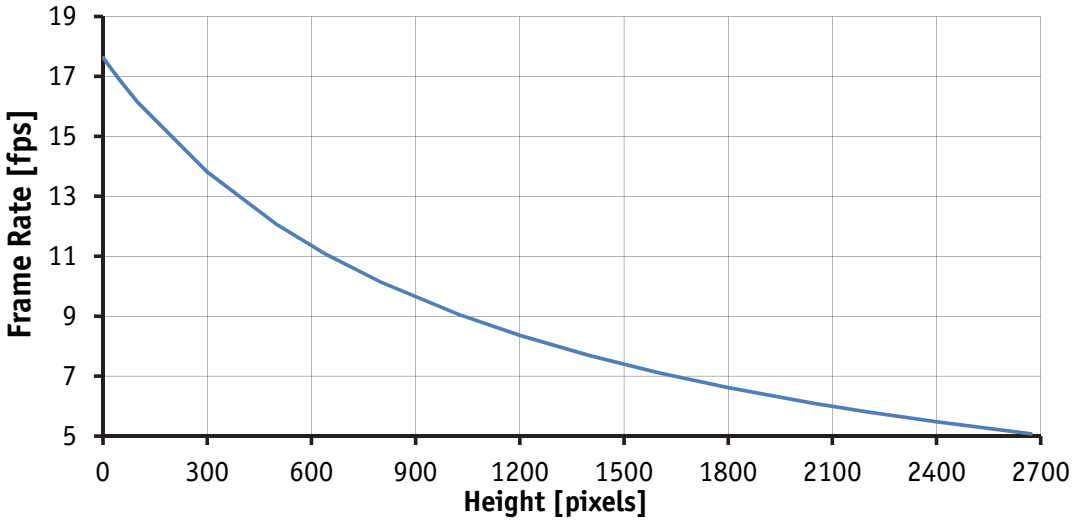


Figure 41: Frame rate vs. height for Prosilica GE4000

Prosilica GE4900

$$\text{Frame rate} = \frac{1}{70.73\ \mu s \times \text{Height} + 69676.59\ \mu s}$$

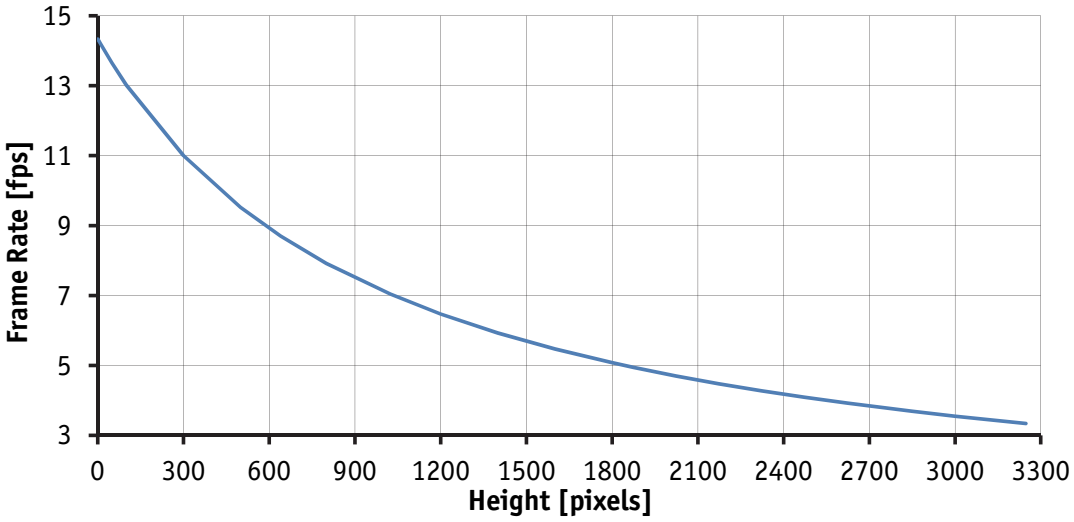


Figure 42: Frame rate vs. height for Prosilica GE4900

Prosilica GE model comparison

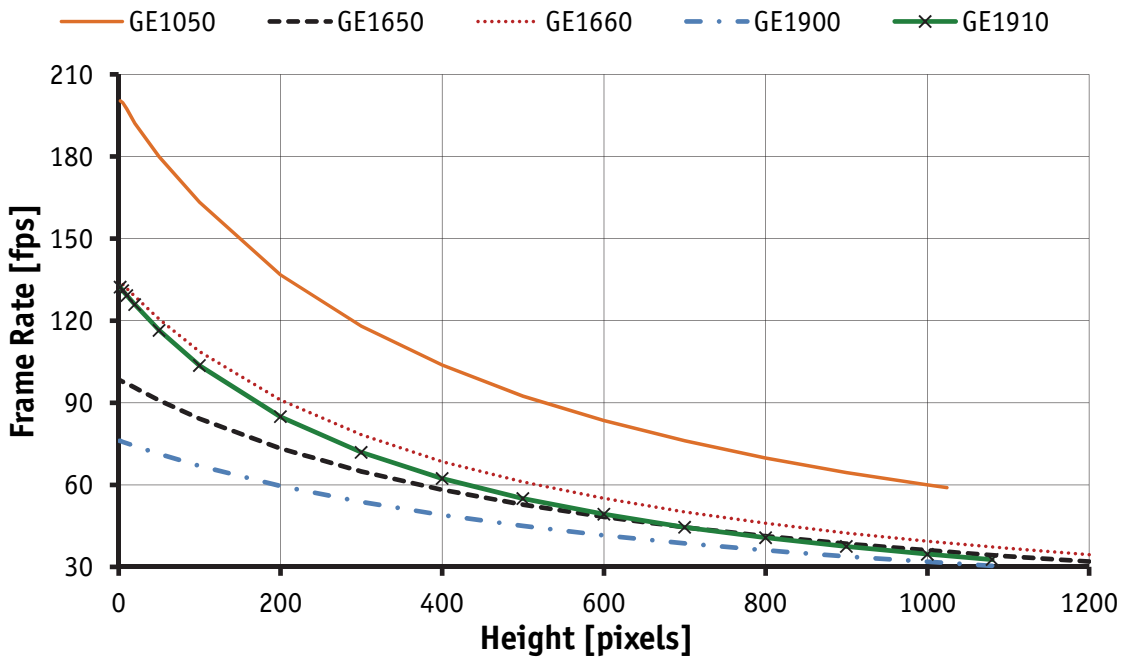


Figure 43: Maximum frame rate vs. height for select Prosilica GE camera models

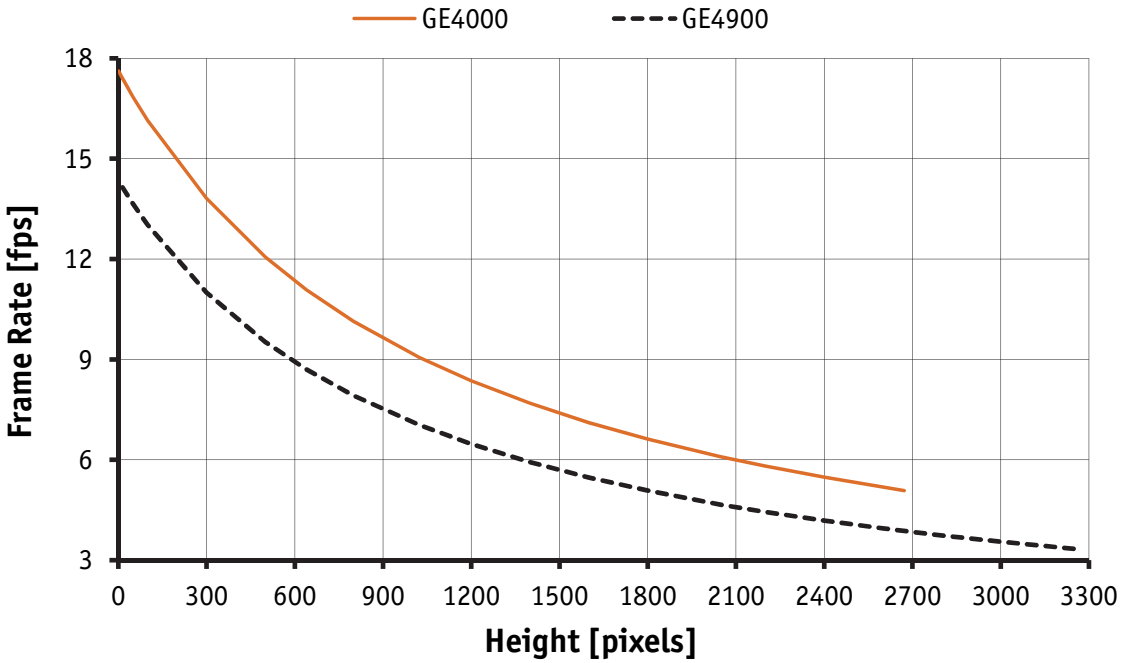


Figure 44: Maximum frame rate vs. height for Prosilica GE4000 and Prosilica GE4900

Additional references

Prosilica GE webpage

http://www.alliedvisiontec.com/us/products/cameras/gigabit-ethernet/prosilica-ge.html

Prosilica GE Documentation

http://www.alliedvisiontec.com/us/support/downloads/product-literature/prosilica-ge.html

AVT VIMBA SDK

http://www.alliedvisiontec.com/us/products/software/vimba-sdk.html

AVT GigE PvAPI SDK

http://www.alliedvisiontec.com/us/products/legacy.html

AVT Knowledge Base

http://www.alliedvisiontec.com/us/support/knowledge-base.html

AVT Case Studies

http://www.alliedvisiontec.com/us/products/applications/industrial-inspection.html

Prosilica GE Firmware

http://www.alliedvisiontec.com/us/support/downloads/firmware.html

Index

C

Camera interfaces 40
CE 11
Cleaning optics 9
Copyright 2

D

Declaration of conformity 11
Document history 6

E

Environmental specifications 8
Exposing (trigger) 50
Exposure (definition) 49
Exposure cycle (trigger) 50
Exposure start delay (signal) 50

F

FCC Class A 11
Flange focal distance
    C-Mount cross section 36
    F-Mount cross section 37

I

Idle (signal) 50
Imaging (signal) 50
Integrating light (trigger) 49
Interline boundary 50
Interline time (signal) 50

L

Legal notice 2
lens protrusion 36
Logic trigger (definition) 49

M

Mechanical drawing
    Prosilica GE C-Mount 32
    Prosilica GE F-Mount 33
    Prosilica GE large format F-mount 34
    Prosilica GE tripod mount 35
Multicast 30

O

Optical flange focal distance 36

P

Precautions 8
Propagation delay (trigger) 49

R

Reading out data (trigger) 50
Readout (definition) 49
Readout data (trigger) 49
Region of interest 30, 52
Registered exposure time (signal) 50
RoHS (2011/65/EU) 11
RS232 42
RxD_RS232 42

S

Sensor row readout cycles 50
Specifications 12
Spectral sensitivity
    Prosilica GE1050 15
    Prosilica GE1050C 15
    Prosilica GE1650 17
    Prosilica GE1650C 17
    Prosilica GE1660 19
    Prosilica GE1660C 19
    Prosilica GE1900 21
    Prosilica GE1900C 21
    Prosilica GE1910 23
    Prosilica GE1910C 23
    Prosilica GE2040 25
    Prosilica GE2040C 25
    Prosilica GE4000 27
    Prosilica GE4000C 27
    Prosilica GE4900 29
    Prosilica GE4900C 29
    Prosilica GE680 13
    Prosilica GE680C 13
Spectral transmission
    IRC30 filter 31

Status LEDs 40
StreamBytesPerSecond 52
Styles 7
Symbols 7

T

Time delay (trigger) 49
Tpd (definition) 49
Trademarks 2
Trigger jitter (definition) 49
Trigger latency (definition) 49
trigger ready (signal) 50
Trigger rules 50
Trigger timing diagram 49

U

User trigger (definition) 49

W

Warranty 2, 8